EAST FRONT GRIZZLY STUDIES

Montana Department of Fish, Wildlife & Parks

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Keith Aune
Project Leader

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

In the conterminous 48 states, only six areas are found to contain self-perpetuating or remnant populations of grizzly bears (Ursus arctos horribilis) (US Fish and Wildlife Service 1981). Of these six areas, the Northern Continental Divide population is contiguous with Canadian and Alaskan grizzly bear populations, and stands the best chance of survival in the future. The northern Continental Divide ecosystem includes Glacier National Park, parts of the Flathead and Blackfeet Indian reservations, parts of five national forests (Flathead, Helena, Kootenai, Lewis and Clark and Lolo), four wilderness areas (Bob Marshall, the Great Bear, Mission Mountains and Lincoln Scapegoat), and a significant amount of state and private land. One of the more unique segments of this ecosystem is the Eastern Rocky Mountain Front where the great plains meet the steep north and south running ridges which form the Sawtooth Range, more commonly known as the Rocky Mountain Front range. Here, along a narrow strip exists the last place where the grizzly bear occupies a plains habitat.

In 1977, research was initiated on the grizzly bear along the east slope of the Rocky Mountains in northwestern Montana. The study, which was continued until 1979 by the Border Grizzly Project, provided much baseline data concerning grizzly bear populations, home range, movement, and habitat use (Schallenberger and Jonkel 1980). Research efforts were continued in 1980 through a contract agreement between the Bureau of Land Management and the Montana Department of Fish, Wildlife and Parks personnel and Border Grizzly Project personnel (Aune and Stivers 1981). In 1986, monitoring of the East Front grizzly population was continued with support and funding from the Bureau of Land Management, the Montana Department of Fish, Wildlife and Parks, the US Forest Service, US Fish and Wildlife Service and Sunmark Exploration Company. The Nature Conservancy, Williams Exploration Company, Mr. Marcellus Merrill, Superior Oil Company, American Petrofina and Sunmark Exploration Company previously committed funding to this project (Aune and Stivers 1982, 1983, 1984, and 1985). Impetus for continuing research on the grizzly bear in this area is the Endangered Species Act of 1973, the grizzly's listing as a threatened species in 1975, and the BLM, USFS and Department of Fish, Wildlife and Parks' need for information on the species in making resource management decisions. This is especially important in relation to increased oil and gas exploration/development and human activities within the study area.

The objectives of the study are: (1) to review and analyze previously accumulated data on grizzly bears, (2) to further delineate and define essential habitat and important use areas within the study area, (3) to determine impacts associated with oil and gas exploration and other human activities, and (4) make recommendations to protect and maintain grizzly populations and habitat. Specific information regarding plant phenology and presence of bear foods, grizzly bear habitat requirements on a seasonal basis, population numbers on a seasonal and year long basis, food habits on a seasonal basis, interaction with other wildlife species, and bear home ranges, movements and distribution were gathered.

DESCRIPTION OF THE STUDY AREA

The study area lies along the east face of the Continental Divide in northwestern Montana (Fig's 1 and 2). The northern boundary is Highway 2 and

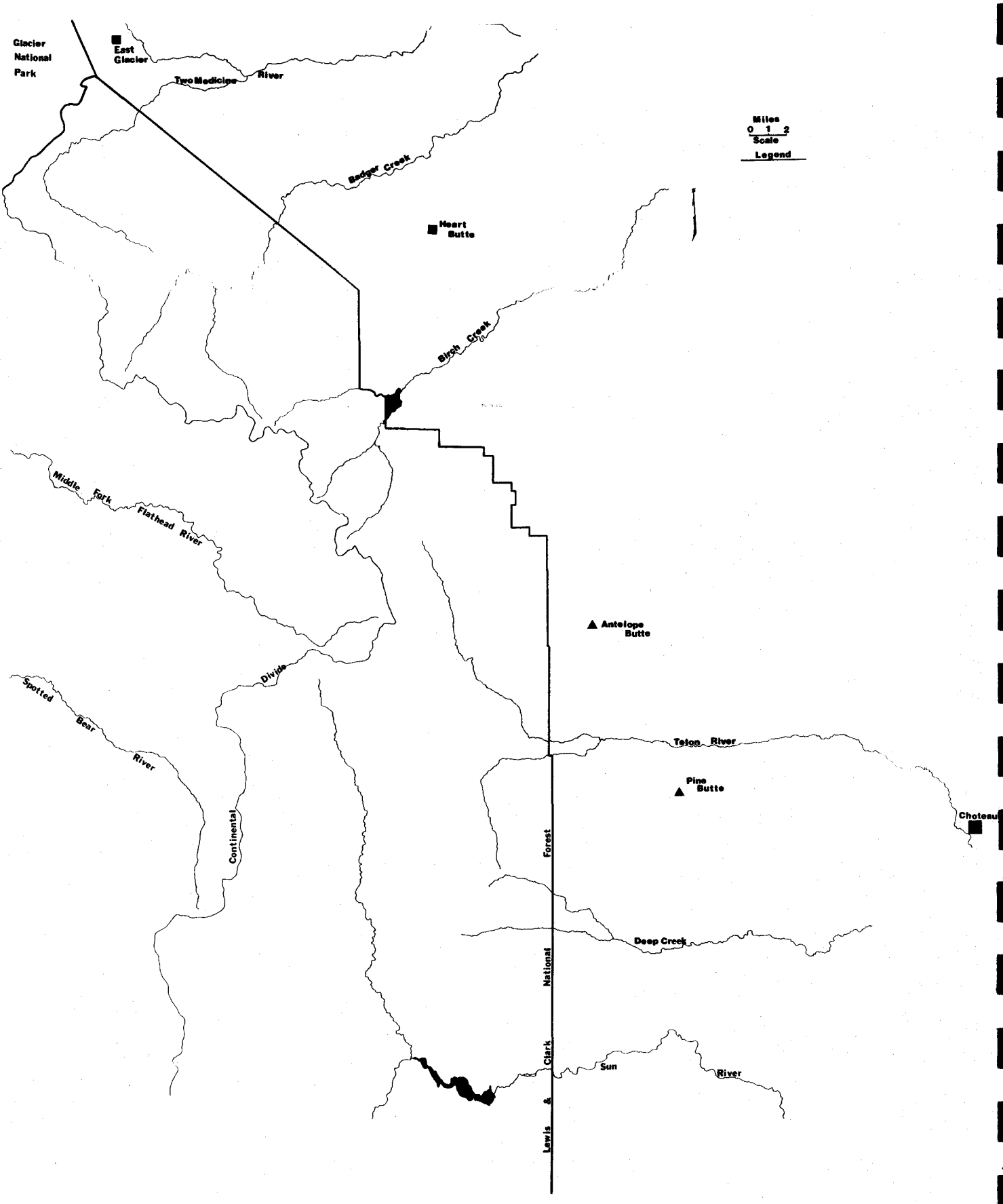

Figure 1. Map of the study area north of the Sun River.

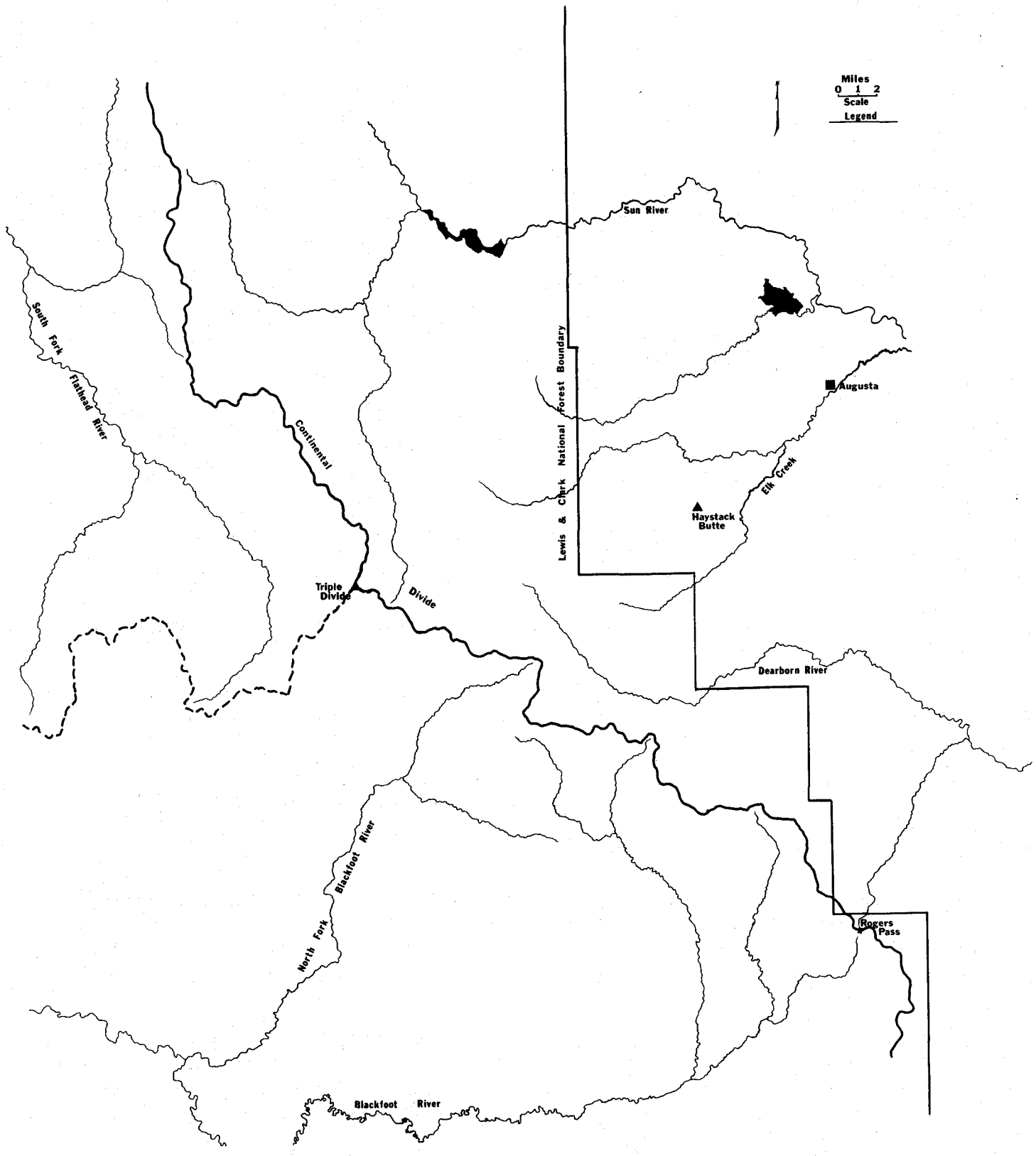

Figure 2. Map of the study area south of the Sun River.

the southern boundary is Highway 200. The study area is bounded on the west by the upper portions of the South Fork of the Flathead River, and the Middle Fork of the Flathead River within the Flathead, Lolo, and Helena National Forest's. The eastern boundary extends to approximately Range 6 West. BLM lands, Montana Department of Fish, Wildlife and Parks wildlife management areas, Forest Service non-wilderness and private lands with federal oil, gas and mineral rights were the primary focus of the research.

The study area has been described in Picton (1960), Schallenberger (1966), Knight (1970), Mudge (1972), Erickson (1972), Frisina (1974), Holdorf (1981), Schallenberger (1974 and 1976), Schallenberger and Jonkel (1978, 1979 and 1980), and USDA Forest Service (1977). Picton and Picton (1975), Schallenberger (1974 and 1976), Dupuyer Centennial Committee (1977) and USFS (1977) present historical information from the study area. Information on grizzly bears in the region has been reported by Jonkel (1976 and 1977), Schallenberger (1974 and 1976), Sumner and Craighead (1973), Hamlin and Frisina (1974), Schallenberger and Jonkel (1978, 1979 and 1980) and Aune and Stivers (1981, 1982, 1983, 1984, 1985, and 1986).

Briefly described, elevations on the study area range from about 4200 ft. (1280 m) in river valleys and plains to the east of the mountains to 9392 ft. (2863 m) on mountain tops. Sedimentary rocks of the limestone and dolomite types generally form the peaks and high ridges, while rocks of the sandstone type often underlie the valley bottoms. Alpine glaciers extensively modified landforms in the past.

Annual precipitation averages about 12 inches (31 cm) at Choteau and up to 65 inches (167 cm) near the Continental Divide. Approximately 80 percent of the precipitation falls as snow. Temperatures range from 90° F (32° C) to about -50° F (-46° C). The climate is characterized by long, cool winters, short, warm summers and strong southwest winds. Climatological data from two reporting stations for 1980-85 along the east front are presented in Appendix A.

The major drainage systems within the study area include the Dearborn River, Sun River, Teton River, Birch Creek and Two Medicine River. Many of the drainages form a characteristic trellis pattern with narrow canyons joining main rivers at abrupt angles (Mudge 1982). Riparian vegetation extends into the high plains and provides food and cover for black and grizzly bears far from mountainous habitat (Schallenberger and Jonkel 1980, Aune and Stivers 1981, 1982, 1983, 1984, 1985 and 1986).

Subalpine fir (Abies lasiocarpa) is dominant and represents climax on most of the timberline forest. Stands of spruce (Picea spp.), white-bark pine (Pinus albicaulis), lodgepole pine (Pinus contorta), Douglas fir (Pseudotsuga menziesii), limber pine (Pinus flexilis), aspen (Populus tremuloides), and cottonwood (Populus trichocarpa) are found on select locations, depending on landform, aspect and elevation. Natural grasslands cover the plains and foothills at lower elevations and intergrade westward into limber pine savanna (Schallenberger and Jonkel 1980).

METHODS

Field Methods

Bears were trapped using front foot snares (Aldrich Snare Co., Clallam Bay, Washington). Before trapping began, snares were boiled for several hours in bark, needles and leaves from willow, kinnikinnick and juniper. Then the snares were lightly waxed with melted paraffin. All trapping equipment and bait were handled with gloves. Bait included carcasses of road-killed deer, beaver carcasses from trappers, horses and cattle, plus miscellaneous meat scraps.

Snares were set at the mouth of log cubbies, on trails, and occasionally a dip or barrel set was made. Cubbies were built and prebaited before snares were set. A drag, which consisted of a piece of ripe bait on a rope, was pulled between each snare set and along bear travel routes to attract bears to the set. Warning signs were posted announcing the general location of the set to minimize human/bear encounters. The traps were checked by vehicle or with saddle horse and pack string, daily.

Captured bears were darted with a Palmer Cap-chur gun. Phencyclidine hydrocholoride (Sernylan) and promazine hydrochloride (Sparine) mixed in equal portions were used to immobilize grizzly bears. A 2:1 ratio of ketamine hydrochloride (Ketaset) and xylazine (Rompun) was used on small grizzly bears and black bears.

Grizzly and black bears were marked with two colored plastic ear tags, all with the same number. One tag was placed in each ear. A numbered lip tattoo which matched the ear tag number was applied to the inside upper lip.

Grizzly bears were fitted with radio transmitters in the 164 MH range (Telonics, Inc., Mesa, Arizona). Ear tag transmitters (Telonics, Inc., Mesa, Arizona) were fitted on yearling grizzlies. Small grizzlies were not collared to avoid problems associated with increasing neck girth of growing individuals and the possible restriction by the radio-collar. All collars placed on subadult grizzlies were padded with foam up to two inches thick or had breakout spacers inserted to allow for expected increases in neck girth over time.

Once trapped and drugged, physical measurements of the bear were taken. Weight was determined using a cattle weighing tape or a spring scale for bears under 300lbs. The first premolar was extracted and used to determine age of the bear from cementum annuli counts (Stoneberg and Jonkel 1966).

Radio-instrumented bears were monitored during frequent (twice weekly) aerial flights made in a Piper Supercub. The airplane was equipped with a belly-mounted antenna system. Black and white photos were taken at each location for future reference. Ground tracking efforts were conducted immediately after aerial flights were completed. All locations were plotted on USGS 1:24,000 quad maps by UTM coordinates. Bears were tracked until they denned or until the radio malfunctioned.

Specific radio locations made by ground and aerial tracking efforts were visited to determine the reasons for the bears' presence at each site. Scats, tracks, beds, digging sites, den sites, destruction of rotten logs, dug up squirrel caches, marking trees, hair on fences and other objects, trails, evidence of

feeding activity or any other evidence of activity were noted. A 375 m^2 (0.1 acre) circular plot was delineated within the activity site. Plant species phenology and canopy coverage of each were recorded at the site. Vegetation structure was determined by assigning canopy coverage values to structural tree and shrub heights. Plants were identified according to Hitchcock and Cronquist (1973).

Scats and reports of grizzly bear sightings, tracks, dens, kills and depredations were collected from many sources during the study. Federal and state government agencies, outfitters, guides, hunters, ranchers, and other outdoorsmen cooperated by reporting such information.

Grizzly scats were collected, tagged and frozen. Scats were differentiated as to species when collected from unknown bears. Scats of greater than 2-inch diameter or 1 quart in volume were labeled grizzly bear scats. Some scats were differentiated as to species by keying guard hairs found in beds and on trees or brush or from tracks found near the scat collection site. Most of the grizzly scats collected were from known radio-collared grizzlies.

Activity patterns were determined by 24-48 hour continuous monitoring of individuals. Real time motion sensing collars were placed on bears to increase reliability of activity data. Nonmotion-sensing collars could yield activity data by interpretation of signal strength by an experienced observer. Motion-sensing collars are designed to transmit in two different modes, depending on the collar position. Constant transmission in either mode indicates a stationary collar. Intermittence of mode indicates motion of collar, and bear.

Bears were selected for 24-48 hour monitoring according to their availability and proximity to areas of disturbance. Instrumented bears were ground tracked by foot, horseback, or vehicle, for as long as possible. Observers monitored the bears' every one-quarter to one-half hour, from as close as possible (for maximum radio reception) without disturbing the bear. Activity and locations were determined by triangulation, signal integrity, visual contact, or state of transmitted mode. Information recorded on the activity forms included date, bear number, observers, receiver type, observation time, location of observer, location of bear, signal strength, consistency or intermittency of signal, and transmitter mode.

Dens were located by random chance, by helicopter surveys in denning habitat, and by radio tracking bears to their dens from air or ground. Dens were inspected on the ground as time permitted. Pertinent data gathered from each inspection included elevation, aspect, slope, habitat type, land type, den type and condition of the den. Dens located by helicopter were photographed with color slide film from low altitudes while hovering above the den.

The current dominant class of livestock grazing at each radio location was reported and coded. Also, each vegetation plot conducted in the field was rated from 0-5 where 0 would describe an area not grazed for 2 years or more and 5 described an area which appeared overgrazed. Occular estimates were used to appraise the site condition.

Data Analysis

Distribution, Home Range, and Movement

Observation data were plotted on USFS (½ inch=1 mile) maps to record distribution. Distribution maps for each spring, summer and fall season were prepared. The information collected since 1980 was recorded by UTM's and section, township and range. Each observation represented from one to eight grizzly bears. Radio locations were included as an observation and were plotted on both USFS (½ inch=1 mile) maps and USGS topographic quadrangle maps. Grizzly observation data were coded then entered into computer files for analysis using SAS computer software.

Grizzly bear home ranges were described by the minimum home range method (Mohr 1947, Hayne 1959) and the modified minimum method (Harvey and Barbour 1965). Home range maps were created with the aid of a Honeywell computer and plotter. The Telday home range program was provided by the Montana Department of Fish, Wildlife and Parks. Area calculations for the minimum home range of each bear were completed on the computer. Modified minimum home range area measurements were done using a planimeter.

To quantify daily movements, all consecutive day radio locations were pooled over a 10 year period (1977-1986). Straight line distances (in meters) from 1 day's location to the next, were determined using each day's UTM coordinates to calculate the hypotenuse of a right triangle. Where there were more than one location on each consecutive day, the pair of coordinates yielding the greatest distance was used. These daily movements were categorized by season. Seasonal dates were spring - den emergence through June, summer - July through August, and fall - September to den entrance.

All radioed bear movements recorded during 24-48 hour monitoring were plotted on USGS topographic quadrangle maps. Straight line distance between coordinates recorded at the beginning and end of a 24-hour monitoring session were measured. These were compared to the distance planimetered from a mapping of the bears' actual movements.

The distance between consecutive radio fixes was calculated on a computer. The Telday program provided a calculation option which outputs the mean distance, standard deviation and range of distances between consecutive radio fixes. Comparisons were made between bears and years.

Activity Patterns

Activity patterns determined by radio telemetry in 1980-83 were recorded in a slightly different format than during 1985-86 (Aune et. al. 1984). During 1980-83 activity was categorized as stationary active, active, or inactive (Aune and Stivers, 1982). Not all radioed bears were fitted with activity sensitive collars and most monitoring was conducted on the lowland front country. Monitoring was focused on the periods when bears were most active and less intense during the inactive period. Objectives were primarily to define movements rather than to quantify activity patterns.

In 1985 and 1986 activity patterns data collection and analysis followed those described by Garshelis and Pelton (1980). Data were gathered from mostly backcountry settings. Motion sensitive collars were monitored in all sessions.

Sessions were selected from the 1979-86 activity patterns data which could be formatted into 15 minute monitoring intervals according to methods of Garshelis and Pelton (1980). These sessions were divided into lowland sessions occurring along the low elevations of the Rocky Mountain Front and backcountry sessions occurring in remote wilderness/semi-wilderness settings. Average activity patterns were created for each bear group. Differences in the average hours spent in vigorous versus moderate activity were compared between each group of bears. Vigorous activity was defined as a probability of activity greater than 50 percent. Moderate activity was defined as a probability of activity less than 50 percent. A chi-square test was used to test differences between each group in hours of each level of activity. Analysis of variance was used to test the significance of differences between levels of activity for bear groups.

Food Habits

Frozen and dried scats were soaked then washed through two wire mesh screens twice. The first wash, using hot water was followed by a second with cold water. Coarser materials gather in the coarse mesh screen (0.156), while finer materials gather in the finer mesh screen (0.0937 inch). The contents of each screen were then placed in a large porcelain pan. Cold water was added and the scat material examined. Dissecting and compound microscopes were used to aid in identification. Items present were identified as to genus and species when possible. The parts of each item were also identified (e.g., leaf, stem, root, berry, etc.). The percent volume of each item was visually estimated. Data from each scat including information about the collection site were coded on computer sheets. Data were sorted and analyzed by computer methods.

The frequency, percent frequency, total volume, percent volume, percent composition, importance value and importance value percent were calculated. Formulas are presented below:

Frequency = Number of scats having the same item

$$\text{Frequency percent} = \frac{\text{Frequency of item}}{\text{Total number of scats}} \times 100$$

Total volume - Total volume of the same item in all scats of the sample

$$\text{Total volume percent} = \frac{\text{Total volume of item}}{\text{Total volume of scat samples}} \times 100$$

$$\text{Percent composition} = \frac{\text{Total volume of item}}{\text{Number of scats with item}} \times 100$$

$$\text{Importance value} = \frac{\text{Percent composition X percent frequency}}{100}$$

$$\text{Importance value percent} = \frac{\text{Importance value of item}}{\text{Sum of importance values for all items}}$$

Den Studies

Dens were located by helicopter or inspected on the ground and were plotted on USGS and USFS (½ inch = 1 mile) maps by UTM's or section, township and range. Physical characteristics data of dens inspected on the ground were derived from actually measuring and observing. Physical characteristics data from dens located by helicopter were derived from both observation (with the aid of color slides) and interpretation of data from USGS quad maps. Physical characteristics data from dens not visited on the ground but accurately plotted on USGS maps by UTM's were extracted from maps and aerial photographs of the area. Physical characteristics data were summarized and put into tables. Data on entrance and emergence from dens by grizzly bears were determined by radio monitoring individuals.

Impacts of Oil and Gas Exploration and Development Activities

Home ranges were mapped in relation to oil and gas drilling and seismic exploration activities. Radioed bears were monitored for 24-48 hour periods in the area of oil and gas exploration/development activities. Grizzly bear movements and locations were plotted by UTM's on USGS quad maps.

Accurate records of oil and gas drilling activity and the associated phases of activity were kept. Seismic activity information was recorded by the USFS. These were plotted on ½" - mile maps for annual recording of activities.

Two methods were employed to test the hypothesis that grizzly bears were displaced by seismic activity and separated their activities both in time and space. The first method involved mapping bear relocations on ½" to 1 mile scale maps for the period of time that a specific seismic project was conducted. Each radio location was dated. Then seismic lines were mapped on the same scale and each was separated into sections with appropriate dates when major activities (blasting, helicopter crews, etc.) was prevalent. It is recognized that some preparatory activity (i.e. survey crews) occurred on each section of line prior to the major survey activities. Distances were measured from each radio location to the nearest active seismic line section. Summary statistics were calculated for each radioed bear and all bears pooled.

The second method involved monitoring specific behavioral responses of bears to seismic activity. These were recorded in the field by intense monitoring of individual bears and were reported on a case study basis.

Habitat Studies

Habitat data recorded at each radio location included elevation, aspect, slope, habitat components, land type, site information, topography, decade of burn where they occurred, current grazing regime, photointerpretive type, distance to perennial water (meters), and distance to road (meters). Each radio location was plotted on USGS maps and then information was recorded from maps, air photos or when the site was visited on the ground. Data from specific locations were coded and recorded in computer files. Data were analyzed by the SPSS statistical program to determine frequency and relative percent of each input parameter.

Aune and Stivers (1983) discussed the habitat components defined for the East Front. However, in 1984 the component classification used in 1983 was modified.

The broader timber component was subdivided into open and closed timber components. These were defined by Aune et al. (1984). Each radio location from 1977 to 1984 was reviewed and reclassified as necessary to accommodate this modification. Habitat component use was described using SPSS cross-tabs program to cross-correlate bear activity, elevational occurrance, and season of use for each component.

Seventeen habitat components have been defined for the Rocky Mountain Front study area. These seventeen specific components are often closely associated with each other. For each radio location the exact component utilized by a bear was recorded. However often times a bear was very near a second or associated component. When this occurs a component association was recorded which gives the component the bear is in first, followed by the associated component. Generally if a bear was located and if a 1/10 acre plot conducted at the site would overlap two components an association was formed.

Habitat types were recorded according to Pfister, et al. (1977) and Mueggler and Handl (1974). Nonwilderness land types follow Holdorf (1981) and wilderness land types follow Holdorf, Martinson and On (1980). Land type maps of the study area were obtained from the USFS. Photo interpretive type maps were obtained by the USFS. This system was defined by C. W. Brown (1970) for USFS timber inventory (unpubl. data). Data for burns and grazing come from current maps of burn locations and allotment maps provided by the USFS. No maps exist for these parameters outside USFS boundaries, but data are being collected for their production.

Vegetation data collected from 375 m^2 circular plots were coded for computer analysis. Programming was developed to analyze and sort plots by habitat type or any input parameter.

Habitat availability was determined using nonmapping methods described by Marcum and Loftsgaarden (1980). Composite home range polygons were developed according to methods described in Servheen (1981). Analysis of utilization-availability data followed Nue et al. (1974) and Servheen (1981).

Habitat Mapping

Constituent elements were defined as spring, summer, fall and denning habitat (USFS, 1984). Six bear management (BMU's) were mapped into denning and spring habitat. Summer and fall habitats included the entire unit area. Detailed component maps were available for two BMU's. Detailed component maps identify specific physical/vegetation communities whereas constituent element maps are collections of these detailed communities into important seasonal habitats.

Criteria were developed to define denning and spring habitat from data developed during intensive studies of grizzly bear. Denning habitats and spring habitats were initially described by elevation. From a data set of 68 grizzly bear dens a lower elevational limit was described for each BMU. An elevation of (6400) 1950 m. ft. and above was used to describe denning rage for 5 BMU's. While one BMU, the Badger-Two Medicine, a 6000 foot elevation was the lower limit used to describe denning habitat. Other criteria used to refine this initial separation were land type, slope, and aspect. Spring habitat was also initially described by an elevation. Analysis results showed that 90% of spring radio locations were below 1950 meters (6400 foot) elevation. Spring habitat was then further refined using landtype, distribution data, habitat component mapping and I.R. photographs to define the boundaries of major seasonal spring ranges. All

mapping was initially conducted on USGS 1:24000 quadrat maps with landtype delineations on these base maps. Complete map polygons were then transposed to 1" to mile scale photo reduced composites of USGS quad maps as a base. Area calculations were made using the geoscan program (MDFWP) with a digitizing table-computer linkup.

Black Bear Investigations

Methods utilized in black bear investigations parallel those described above. Radio collars were placed only on mature animals. Sub-adults and smaller adults were ear-tagged, but not fitted with radio collars. No site inspections of black bear radio locations were made as time limited the development of these studies. Habitat data were extrapolated from maps, air photos and examination of sites from the air. Black bear habitat use data were analyzed with the aid of computer methods described above.

Results and Discussion

Trapping and Radio Tracking

Trap lines were operated in six separate regions within the study area in 1986. Trapping during spring was conducted by two trap teams; one in the Badger-Two Medicine area and another in the Smith Creek - Willow Creek regions. The Smith-William Creek trapline was operated from May 13 - June 4. The trapline in the Little Badger area along the Blackfoot Reservation Boundary was operated from May 15 - June 4. In the Smith-Willow Creek area there were four captures of three grizzlies and 16 captures of 16 black bears. On the Little Badger Line no grizzlies were captured and there were 10 captures of 7 black bears. Traplines were operated in late spring-early summer in the Fairview-Willow Creek area and the N. Fk. Badger area. The Fairview-Willow Creek trapline was operated from June 10 - June 30 and resulted in the capture of one grizzly and 4 captures of 3 black bears. In the N. Fk. Badger area traps were set from June 10 to July 11 and resulted in 6 captures of 5 grizzlies and 8 captures of 8 black bears.

Two summer trap operations were conducted in the S. Fk. Sun Bear Management Unit in an effort to capture a female bear for monitoring. The first was a short trapping effort was conducted in Hoadley Creek from August 8-16. No bears were captured during this effort. The second trapping effort from Sept. 4-13 in the Patricks Basin - Windfall Creek area resulted in the capture of no grizzlies and 5 captures of 4 black bears.

The total research trapping effort in 1986 resulted in the capture and marking of eight grizzlies in 11 captures and 38 black bears in 43 captures. Management actions during 1986 resulted in the capture of 3 grizzlies and 5 black bears. Total capture of bears for research and management in 1986 was 11 different grizzlies and 48 different black bear.

Thirteen different grizzly bears were monitored to some extent during the 1986 report period (Table 1). Bears 312 and 392 cast collars at their den after emergence from the den. Bears 317, 412, and 355 all cast collars during the field season. Bears 498 and 410 died shortly after handling. Bear 410 was killed by a larger male after leaving the trap site while 498 probably suffered post-drugging complications after traveling ½ mile from his capture site.

Table 1. Grizzly bears radio monitored, 1986.

Bear No.	Sex	Age	March-April	May	June	July	August	Sept.	Oct.	Nov.	Total
301*	F	13.5	2	3	5	7	7	2	6	1	33
312*,a	F	3.5	1	–	–	–	–	–	–	–	1
313	F	4.5	3	4	1	7	7	1	7	1	31
316*	F	4.5	3	7	5	6	7	2	3	0	33
317*,b	F	4.5	3	–	–	–	–	–	–	–	3
335	F	8.5	0	0	1	7	6	2	–	–	16
355c	M	10.5	6	5	6	6	6	1	–	–	30
366*	F	7.5	2	4	1	7	8	2	7	1	32
392*,d	M	4.5	1	–	–	–	–	–	–	–	1
410e	M	3.5	–	1	–	–	–	–	–	–	1
412f	M	7.5	–	3	5	2	–	–	–	–	10
466	F	15.5	–	–	1	7	6	2	9	1	26
467	M	3.5	–	–	–	10	6	2	10	1	29
498g	M	7.5	–	–	1	1	–	–	–	–	2
500*,h	F	7.5	5	3	4	6	8	3	5	–	34
			26	30	30	66	61	17	47	5	282
RELOCATED BEARS											
101i	F	3.5	–	2	–	–	–	–	–	–	2
106j	M	4.5	–	–	–	–	–	–	2	–	2
335*,k	F	8.5	3	5	2	–	–	–	–	–	10
			3	7	2	0	0	0	2	0	14

*Includes den location

a Bear 312 cast her collar at her den.

b Bear 317 cast her collar in spring.

c Bear 355 cast his collar in early September.

d Bear 392 cast his collar at his den.

e Bear 410 died after being captured in May.

f Bear 412 cast his collar in early July.

g Bear 498 died after being captured in June.

h Bear 500 was radio located at her den in Oct. but not since.

i Bear 101 was relocated west of the Divide and was illegally killed.

j Bear 106 was relocated and illegally killed.

k Bear 335 has not been located since early September - her fate is unknown.

Grizzlies 101 and 106 were relocated in management actions but both were illegally killed shortly after relocation. Bear 335 could not be radio located after early September and is either dead or her radio malfunctioned. A total of 7 functioning radios were present on the study area by denning time in 1986.

A total of 282 radio contacts were made with 15 different grizzlies during the research monitoring period beginning March 15 and ending November 10 for an average of 31 locations a month. Table 2 presents the distribution of tracking effort for each bear by month. A total of 258 of the radio locations were specific locations.

A total of 14 radio contacts were made with 3 different grizzlies following relocations. These locations were widely distributed throughout the Northern Continental Divide Ecosystem and were not added to East Front research data bases.

Physical Characteristics

Physical measurements were recorded from each grizzly bear captured in 1986 (Table 2). These data were combined with the data from captures in previous years (Aune and Stivers 1981, 1982, 1983; Aune et al. 1984, 1986; Aune 1985) to provide for preliminary analysis of physical characteristics.

To determine if a relationship existed between female nipple length and age of first reproduction we conducted an Analysis of Variance (ANOVA) of mean nipple length by age. This analysis indicated that there was a significant difference ($F=6.14$, $P=0.009$, $N=17$) between ages in mean nipple length. The Student-Newman-Kuels multiple range (SNK) test indicated that females 5 years old and younger had a shorter ($P=0.05$) mean nipple length than females older than 5 years (Table 3).

Aune (1985) reported age at first reproduction for two females as 5.0 and 6.0 years old. In 1986 female grizzly 366 was captured in July and was lactating indicating that she had produced cubs at the age of 7.0 years. Her cubs were not observed at that time nor any other time in 1986 indicating that she lost her cubs. The mean age of first reproduction for these three bears then is 6.0 years. McLellan (1982) reported that in British Columbia females produced their first litters at age 5.0 years. Craighead et al. (1969) reported a mean age of first reproduction of 6.13 years in Yellowstone and Knight and Eberhardt (1985) reported age of first reproduction as 6.0 years in Yellowstone.

Our analyses indicate that a nipple length of at least 12.7 mm may indicate prior reproduction as the minimum length for females 6 years old was 12.7 mm. Further evidence supporting this contention is that grizzly 366 had not produced a litter by age 5.0 years in 1984 and her nipple length when captured in June was 9.7 mm. When captured in 1986 after producing her first litter her nipple length was 16.0 mm. Grizzlies 335 and 500 had nipple lengths of 12.7 and 19.1 mm, respectively, when captured in 1985 after producing their first litters.

Using data from grizzly bear captures in 1986 (Table 4) and from previous years (Aune and Stivers 1981, 1982, 1983; Aune et al. 1984, 1986; Aune 1985) we derived equations for predicting body weight for males, females and both sexes combined. We used two regressions for predicting weight, the first is a $\log_{10}$ - $\log_{10}$ regression of chest girth and weight, the second is a regression of a body index (body length times chest girth squared) and weight (McLellan 1982). The fit (as determined by the coefficient of determination) varied with the regression used and the sex class (Table 4). The best fit ($r^2=0.95$) was for males regressing the body index against weight. Although the sample sizes are small the coefficients of determination (Table 4) indicate that it may be possible to estimate body weight using these equations when scale weight is not possible or impractical to obtain. Relationships between chest girth and body weight have been reported for all species of North American bears (Payne 1976, LeCount 1977, Sterling et al. 1977, Glen 1980, Kingsley et al. 1983, Nagy et al. 1984, Woddell and Brown 1984).

Table 2. Physical measurements and marking data from grizzly bears captured on the Rocky Mountain Front, 1986.

Bear No.	101	106	341	355	366	410	412	464	466	467	498
Date	5/16	10/9	5/14	5/23	7/6	5/20	5/21	6/28	6/28	7/6	6/23
Age and Sex	3.5F	4.5M	2.5F	9.5M	8.5F	3.5M	8.5M	cub F	15.5F	3.5M	9.5M
Girth weight lb.	249	500	175	628	217	172	519	10	217	172	360
kg.	113	227	79	285	98	78	235	5	98	78	163
Scale weight lb.	265	510	205	--	235	190	--	--	210	220	--
kg.	120	231	93	--	107	86	--	--	95	100	--
Body length in.	64.3	71.0	61.8	82.5	71.8	65.5	75.0	35.5	72.8	68.3	74.5
cm.	163.3	180.3	157.0	209.6	182.4	166.4	190.5	90.2	184.9	173.5	189.2
Neck girth in.	26.0	31.0	21.5	33.0	24.8	22.0	31.0	12.0	28.0	22.0	28.1
cm.	66.0	78.7	54.6	83.8	63.0	55.9	78.7	30.5	71.1	55.9	71.4
Chest girth in.	40.0	51.5	36.5	57.0	40.3	36.0	52.0	22.0	40.3	37.3	48.1
cm.	101.6	130.8	92.7	144.8	102.4	91.4	132.1	55.9	102.4	94.7	122.2
Shoulder height in.	36.0	31.0	33.5	37.0	32.8	30.5	37.0	--	35.5	32.8	37.5
cm.	91.4	78.7	85.1	94.0	83.3	77.5	94.0	--	90.2	83.3	95.3
Shank length in.	16.3	19.8	15.5	19.0	11.3	14.6	20.0	6.0	15.0	15.8	14.3
cm.	41.4	50.3	39.4	48.3	28.7	37.1	50.8	15.2	38.1	40.1	36.3
Foot measurements											
Front pad length in.	3.00	3.00	2.75	3.50	2.50	3.13	3.38	1.50	2.75	3.00	3.25
cm.	7.62	7.62	6.99	8.89	6.35	7.95	8.59	3.81	6.99	7.62	8.26
Front pad width in.	5.88	5.75	5.00	6.75	4.88	5.25	6.50	3.00	4.88	5.25	5.81
cm.	14.94	14.61	12.70	17.15	12.40	13.34	16.51	7.62	12.40	13.34	14.76
Front foot length in.	4.88	5.50	4.38	6.00	4.75	5.00	5.75	3.00	4.88	5.25	5.75
cm.	12.40	13.97	11.13	15.24	12.07	12.70	14.61	7.62	12.40	13.34	14.61
Front claw length in.	2.13	2.00	2.25	2.50	2.38	1.88	2.25	1.00	2.75	2.25	2.50
cm.	5.41	5.08	5.72	6.35	6.05	4.78	5.72	2.54	6.99	5.72	6.35
Hind pad length in.	6.50	7.13	6.50	8.50	6.50	6.88	8.13	3.75	6.75	6.88	7.13
cm.	16.51	18.11	16.51	21.59	16.51	17.48	20.65	9.53	17.15	17.48	18.11
Hind pad width in.	5.13	5.25	5.75	6.25	4.25	4.88	6.25	2.63	4.50	4.88	5.50
cm.	13.03	13.34	14.61	15.88	10.80	12.40	15.88	6.68	11.43	12.40	13.97
Hind foot length in.	8.4	9.8	8.1	10.5	7.9	8.5	10.1	5.0	8.8	8.8	9.0
cm.	21.3	24.9	20.6	26.7	20.1	21.6	25.7	12.7	22.4	22.4	22.9
Testes length in.	--	--	--	4.00	--	2.25	3.75	--	--	2.50	3.25
cm.	--	--	--	10.16	--	5.72	9.53	--	--	6.35	8.26
Testes width in.	--	--	--	2.35	--	1.25	2.25	--	--	1.50	1.75
cm.	--	--	--	5.72	--	3.18	5.72	--	--	3.81	4.45

Table 2. (continued)

Bear No.	101	106	341	355	366	410	412	464	466	467	498
Baculum length in.	--	6.00	--	6.50	--	5.00	8.75	--	--	5.00	5.38
cm.	--	15.24	--	16.51	--	12.70	22.23	--	--	12.70	13.67
Mammae length in.	0.50	--	0.38	--	0.63	--	--	--	0.63	--	--
cm.	1.27	--	0.97	--	1.60	--	--	--	1.60	--	--
Mammae diameter in.	0.38	--	0.50	--	0.38	--	--	--	0.50	--	--
cm.	0.97	--	1.27	--	0.97	--	--	--	1.27	--	--
Reproductive status	Esterous	--	--	--	Lactating	--	--	--	Lactating	--	--
Color	Blonde Brown Leggings	Brown Gold Head	Brown Dark Leggings	Silver Tip-Brown	Silvertip Brown Leggings	Blonde Dark Leggings	Dark Brown	Blonde Dark Leggings	Blonde Dark Shoulders	Blonde Dark Leggings	Silvertip Brown Leggings
Fat Index	3	4	3	3	5	3	3	2	2	3	3
Ear tags left	101 Yellow	106 Yellow	341 Green	355 Green	366 Green	410 Green	412 Green	464 Green	466 Green	467 Green	498 Green
right	101 Yellow	106 Yellow	341 Green	355 Green	366 Green	410 Green	412 Green	464 Green	466 Green	467 Green	Broken Green
Tattoo	101 Green	106 Black	341 Black	355 Green	366 Black	410 Green	412 Green	464 Black	466 Black	467 Black	498 Black
Collar color	Black	Black	None	Black	Black	Black	Black	None	Black	Black	Black

Table 3. Mean teat length and diameter in each age class of female bears, 1980-86.

Age	N	Mean (mm) Teat Length	N	Teat Width	Observed Lactation
2	3	8.6	3	8.5	No
3	5	7.9	3	2.1	No
5	1	9.7	1	9.7	No
6	1	19.1	1	19.1	Yes
7	1	12.7	1	12.7	Yes
8	3	15.9	2	11.2	Yes
12	1	25.1	1	9.7	Yes
15	1	16.0	1	12.7	Yes
19	1	19.1	-	-	Yes
	17		13		

Table 4. Equations for predicting live weights of grizzly bears on the Rocky Mountain East Front.

Sex	Equation[a]	r^2	N
All bears	$W=-1.407+0.0000670I$	0.85	27
	$W=2.82177*^{2.427}$	0.89	27
Males	$W=-7.947+0.0000737I$	0.96	14
	$W=-3.08935*^{2.566}$	0.93	14
Females	$W=19.322+0.0000522I$	0.57	13
	$W=-2.38314*^{2.204}$	0.80	13

[a] W=Body weight, I=Body index (body length times chest girth squared), G=Chest girth.

An ANOVA by age was used to determine if testes length or width, or baculum length could be used to estimate sexual maturity in males. The results indicated that a significant difference existed for mean testes length (F=6.98, P=0.0001, N=32), mean testis width (F=10.98, P=0.0001, N=32), and mean baculum length (F=5.98, P=0.0002, N=35) but the SNK multiple range test failed to reveal any biological significance for these measurements in testing for sexual maturity. Plots of these mean measurements however, indicate that they may be useful as a measure of growth (Figure 3).

Distribution

Distribution of grizzly bears was determined by plotting 3,170 observations gathered between the years 1976 and 1986 for the Sun River North study area (Fig. 4). A total of 698 observations were reported in Schallenberger and Jonkel (1980). During the 1980-86 field seasons 2,474 observations were collected. About 31.6, 40.1, and 28.3 percent were collected during the spring, summer, and fall respectively (Table 5).

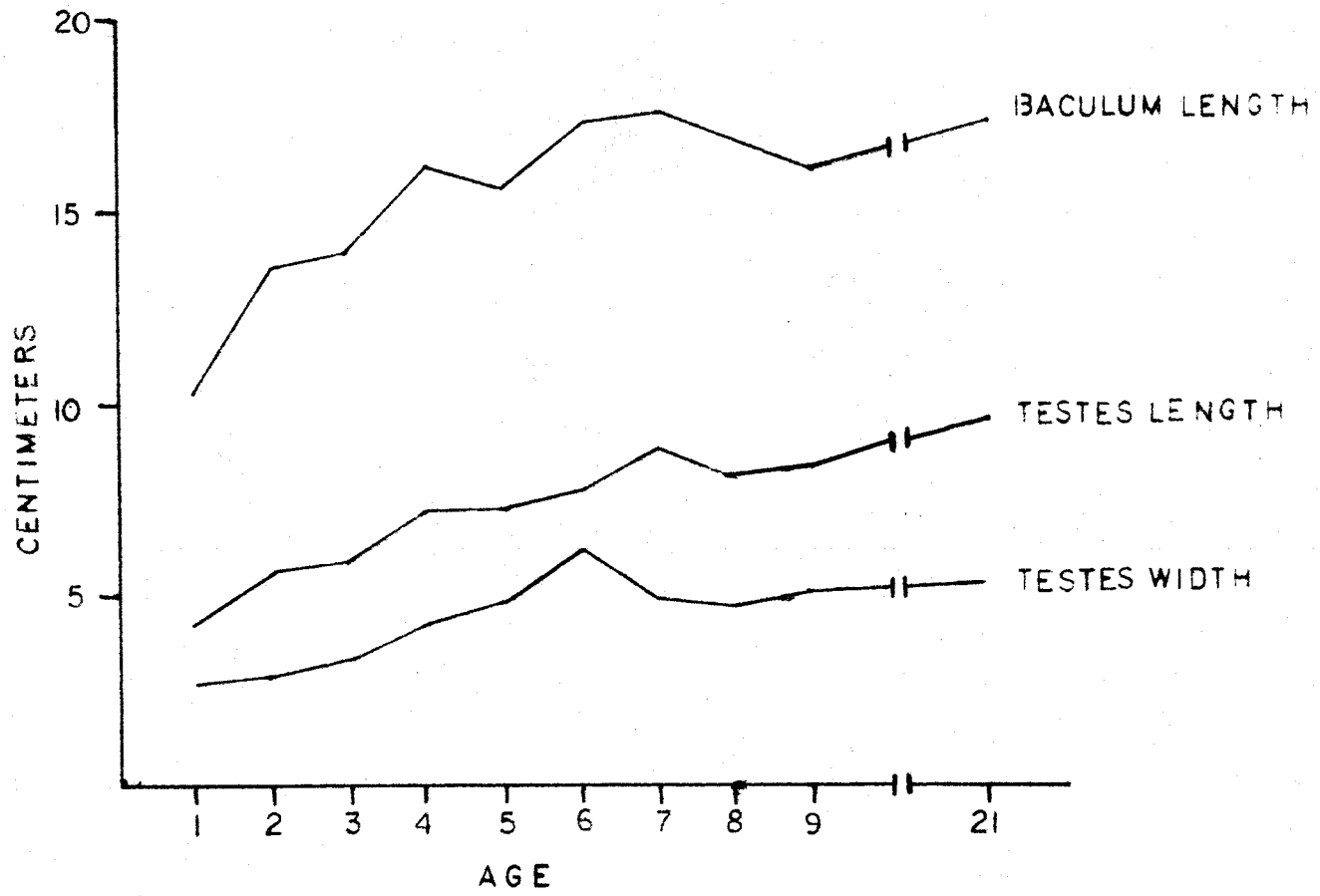

Figure 3. Mean baculum length, testes length, and testes width of male grizzly bears by age class, 1980-86.

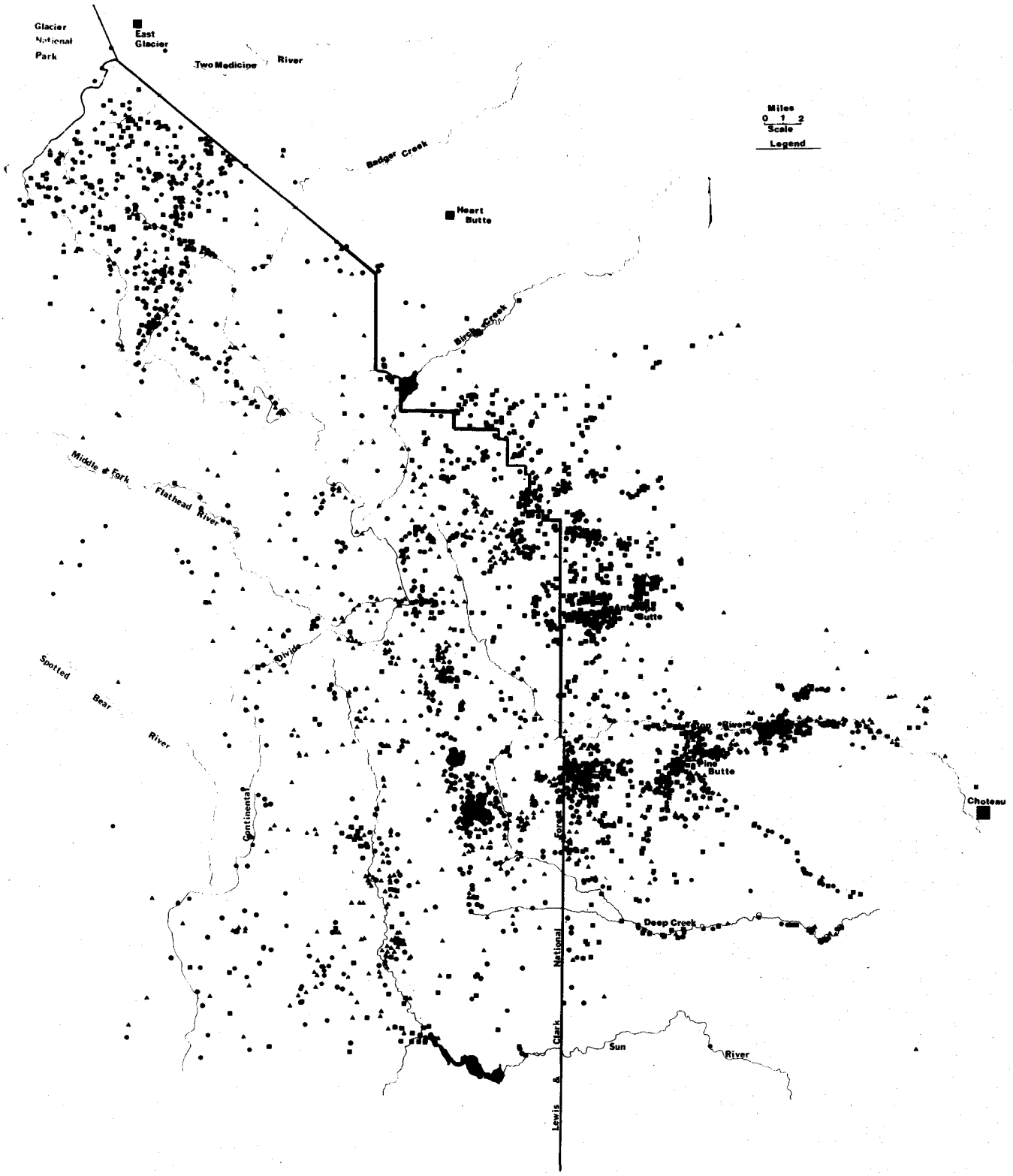

Figure 4. Distribution of 3,170 grizzly bear observations, 1976-86, north of the Sun River.

Table 5. The number of observations plotted on the Sun River North[1/] overall and seasonal distribution maps, 1976 - 1986.

Period	Spring	Summer	Fall	Total
1976-79[2/]	148	345	205	698
1980	50	83	62	195
1981	186	128	89	403
1982	173	200	148	521
1983	183	189	165	537
1984	84	149	94	327
1985	116	87	71	274
1986	61	92	64	217
TOTAL	1,001	1,273	898	3,172

1 - North of Township 21-22 line.
2 - Reported in Schallenberger and Jonkel, 1980.

Figures 5, 6, and 7 show the seasonal distribution of observation data. Seasons are defined as spring (March - June 30), summer (July 1 - August 30), and fall (September 1 - November).

Distribution of grizzly bears south of the Sun River was determined by plotting 759 observations gathered between 1976 and 1986 (Fig. 8). A total of 289 observations were reported in Schallenberger and Jonkel (1980) and 470 observations were collected during 1980-86 field seasons. Approximately 40.2, 33.8, and 26.0 percent of the observations were collected during spring, summer and fall, respectively (Table 6). Figures 9, 10, and 11 show the seasonal distribution of observation data south of the Sun River. Seasons are defined as above.

Table 7 presents the 1986 observation data by type for each season, north of the Sun River. Table 8 presents observation data by type for each season, 1986, for the area south of the Sun River. Observation data north of the Sun River is composed of 67.3 percent radio locations whereas south of the Sun River 55.7 percent of the distribution data is from radio locations.

Seasonal distribution maps reveal the importance of river valley, creek bottom and foothills habitat to grizzly bears during the spring. Schallenberger and Jonkel (1980), Servheen (1981), and Jonkel (1980) reported the importance of low elevation wet sites and creek bottoms to grizzly bears in the spring. The concentration of grizzly bears along these foothills, creeks and river bottoms appears to be related to the early snow melt from these sites and the phenology of important bear foods. Grizzly bears distribute themselves more evenly throughout the area during summer and fall.

Several biases exist in present distribution maps. The study area is large and back country areas received less field effort. Much of the information in these regions reflects a low intensity of field work, rather than the true distribution of grizzly bears. Restricted access to some private land also prohibited field work in areas which deserve attention. The Deep Creek and Harrison Basin area appears to receive high grizzly bear use; however, observation data are limited in this area. Another area deserving more attention is the Birch Creek-Lower Badger area west of Heart Butte.

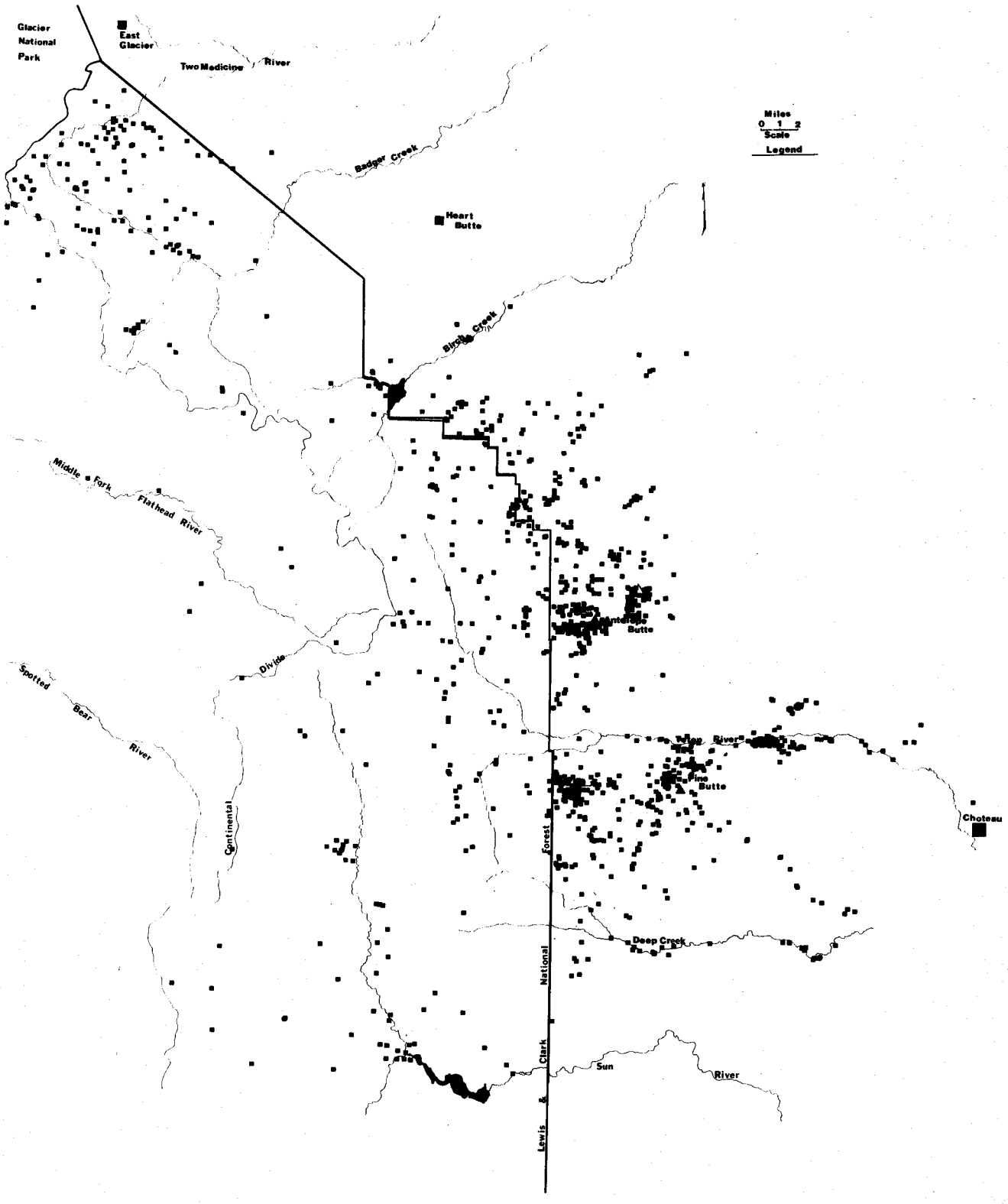

Figure 5. Distribution of 999 grizzly bear observations collected during spring, 1976-86, north of the Sun River.

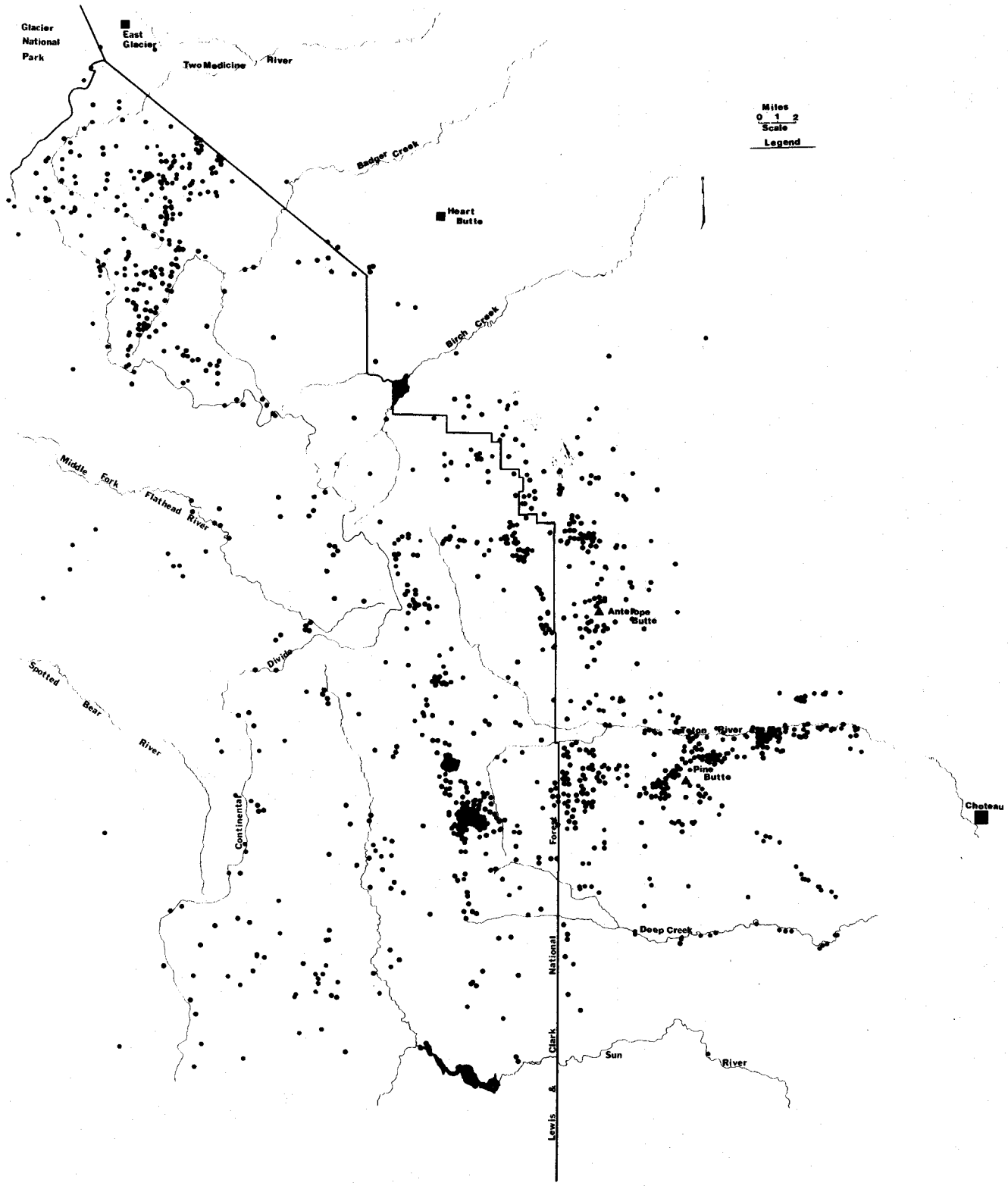

Figure 6. Distribution of 1,273 grizzly bear observations collected during summer, 1976-86, north of the Sun River.

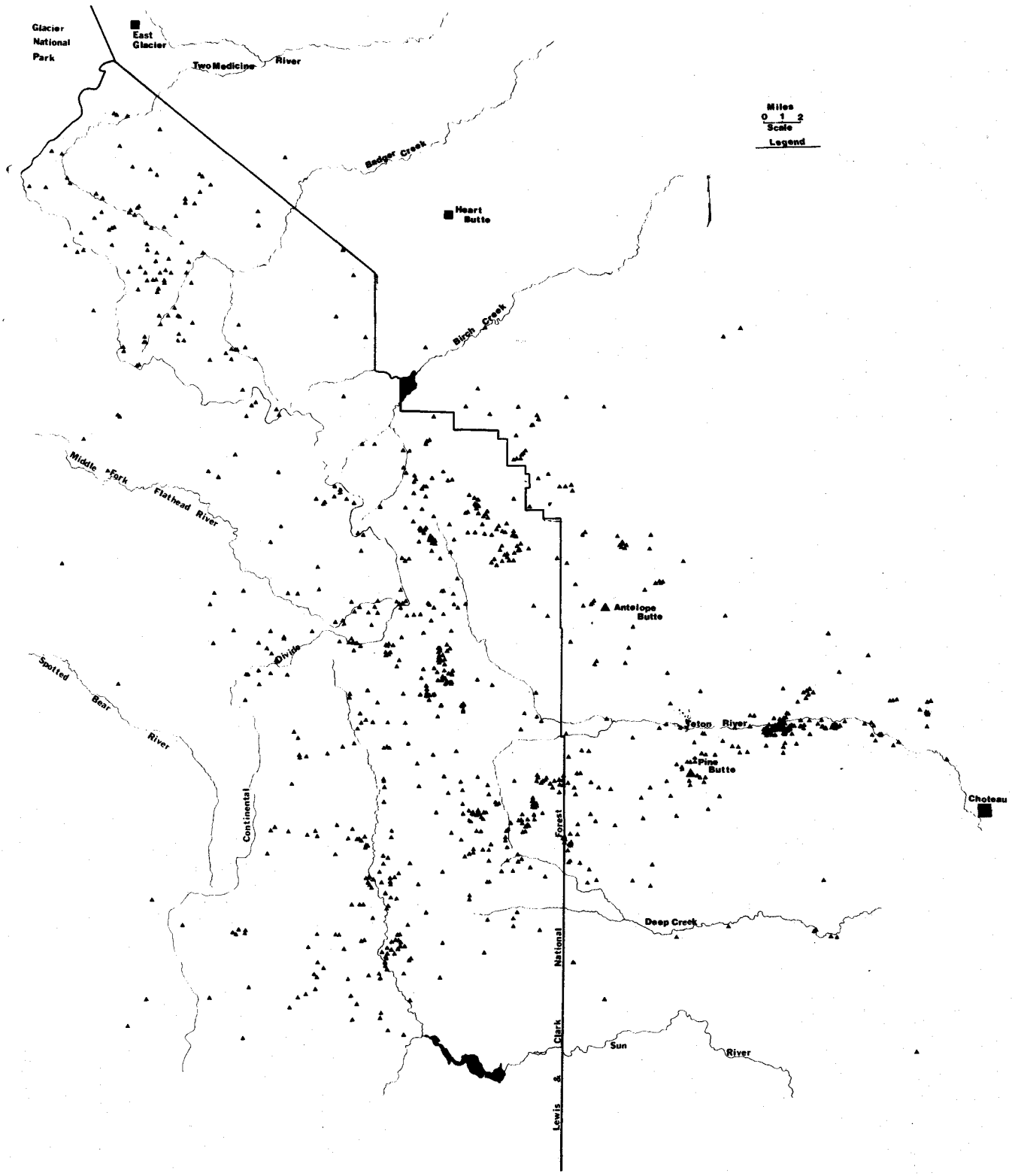

Figure 7. Distribution of 898 grizzly bear observations collected during fall, 1976-86, north of the Sun River.

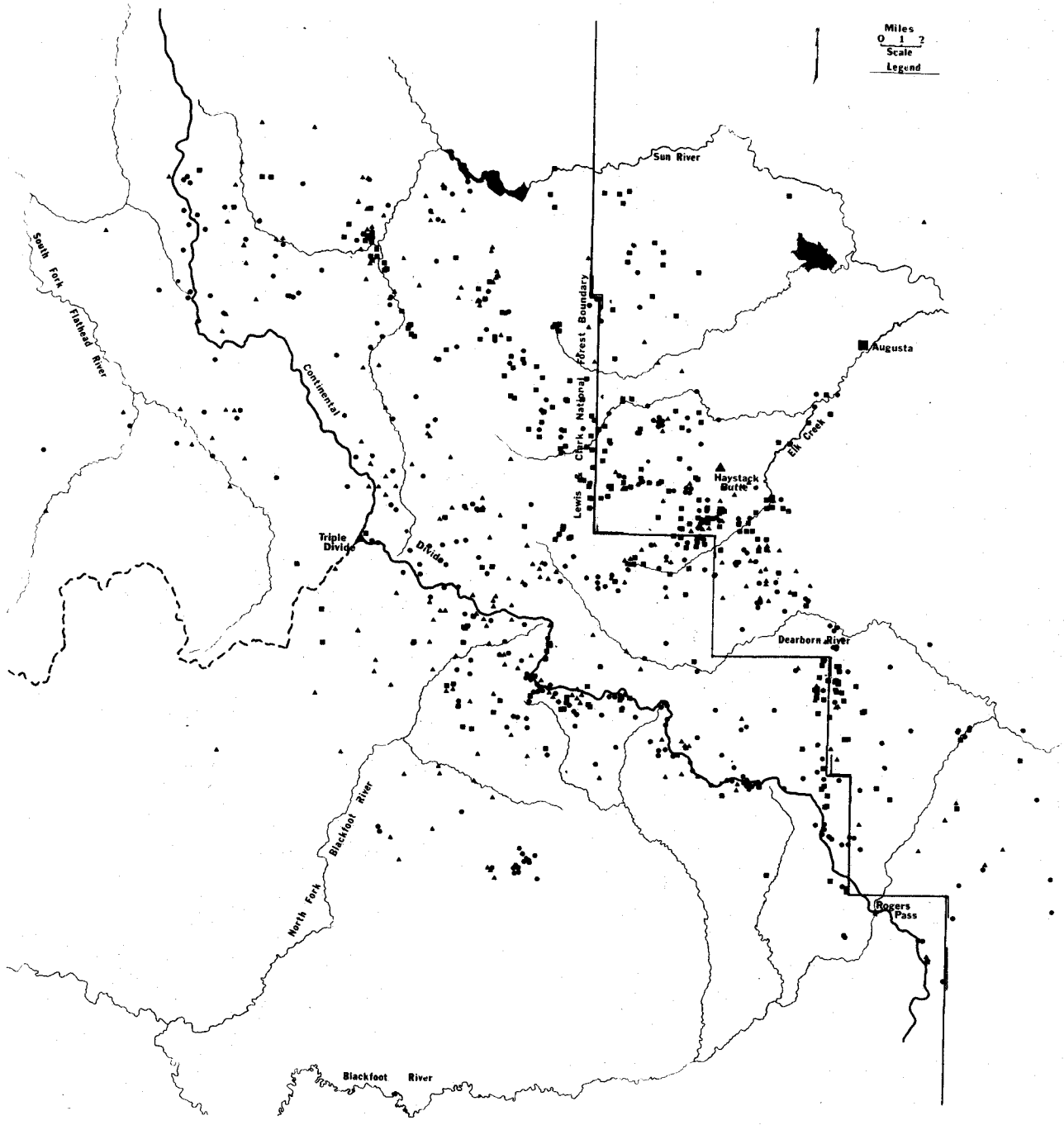

Figure 8. Distribution of 759 grizzly bear observations 1976-86, south of the Sun River.

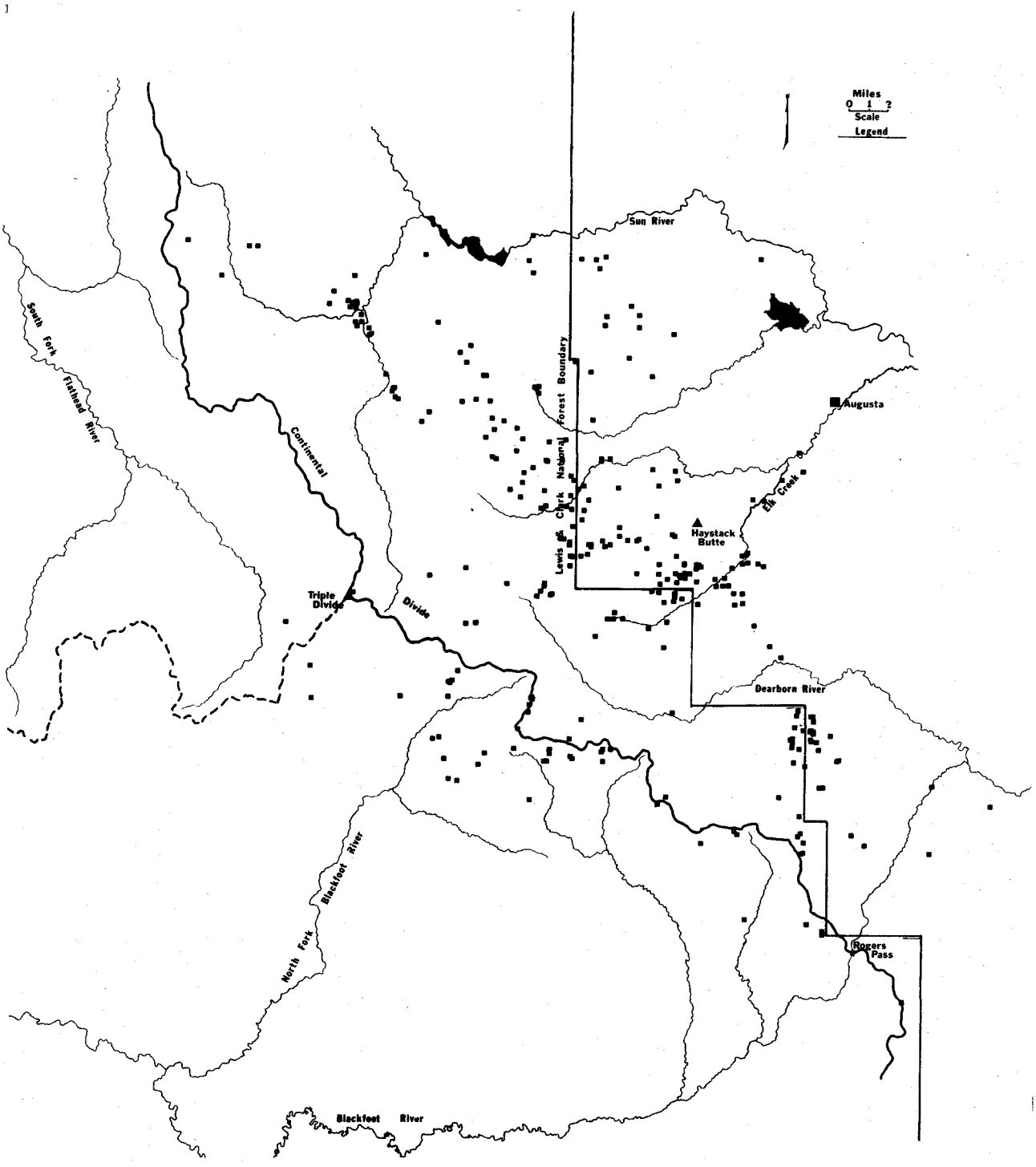

Figure 9. Distribution of 305 grizzly bear observations collected during spring, 1976-86, south of the Sun River.

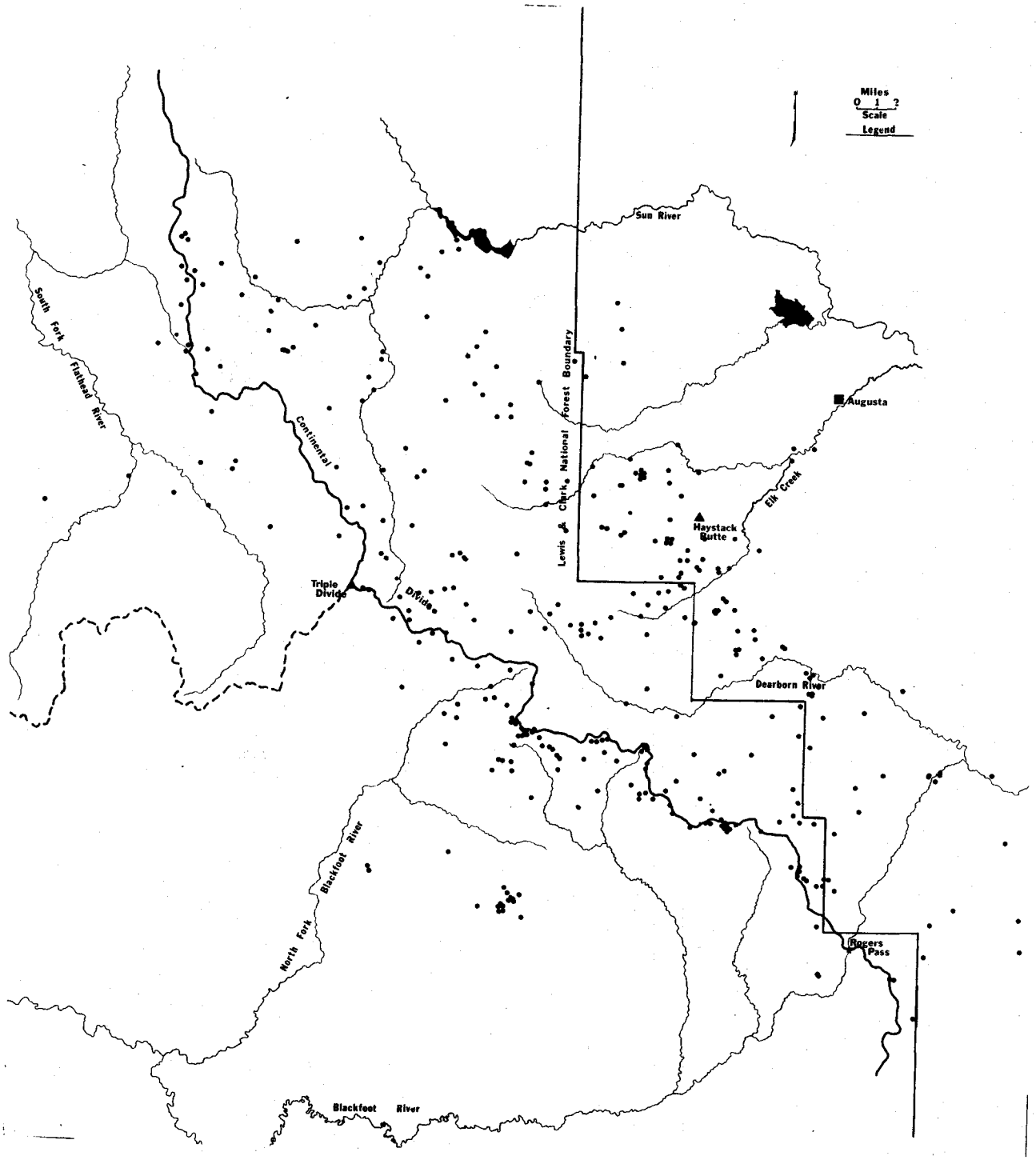

Figure 10. Distribution of 257 grizzly bear observations collected during summer, 1976-86, south of the Sun River.

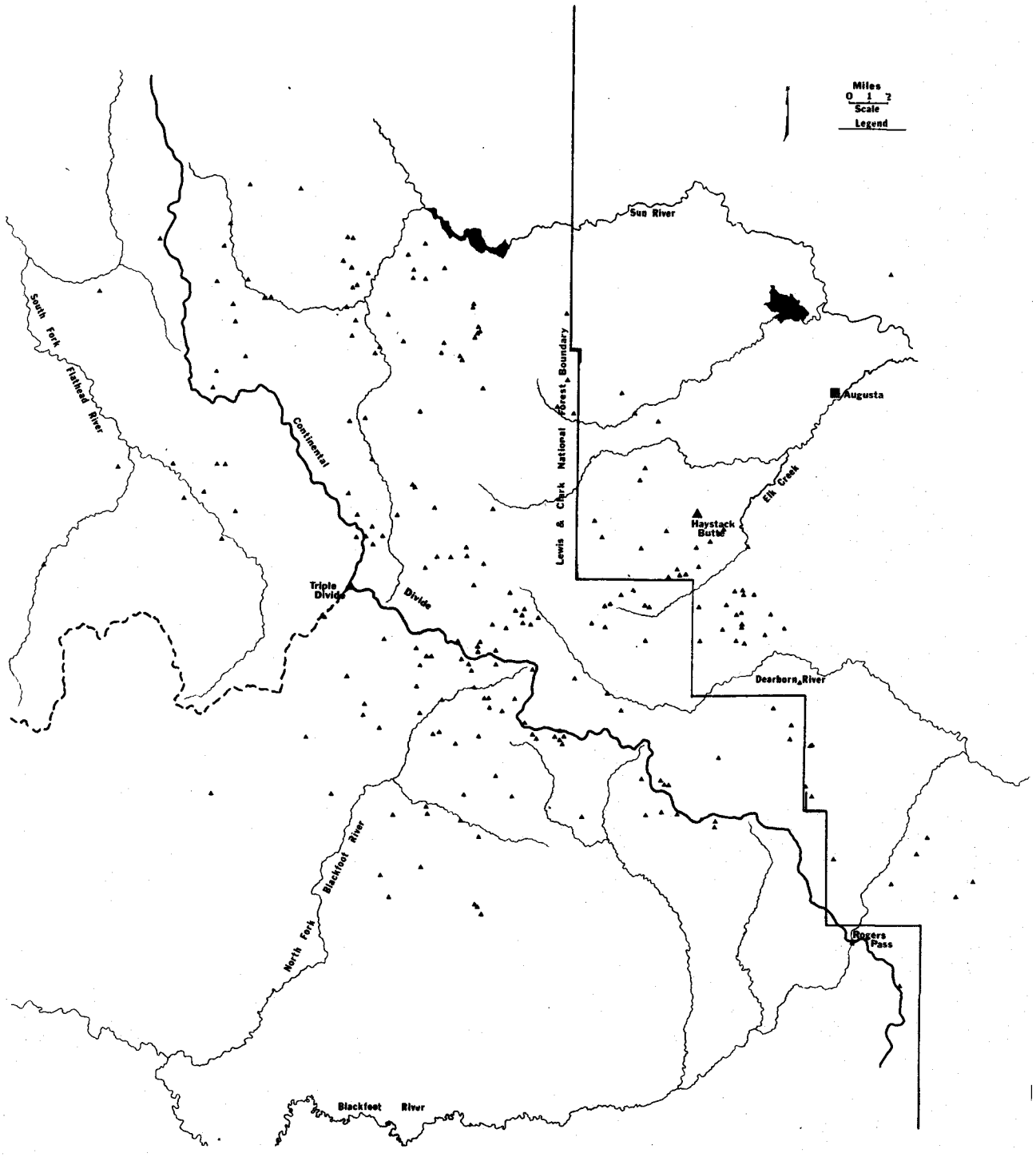

Figure 11. Distribution of 197 grizzly bear observations collected during fall, 1976-86, south of the Sun River.

Table 6. The number of observations plotted on the Sun River South [1/] overall and seasonal distribution maps, 1976 - 1986.

Period	Spring	Summer	Fall	Total
1976-79[2/]	87	93	109	289
1980-83	57	37	6	100
1984	23	29	30	82
1985	71	55	35	161
1986	67	43	17	127
TOTAL	305	257	197	759

1 - South of township 21-22 line.
2 - Reported in Schallenberger and Jonkel, 1980.

Table 7. Number of observations for each season by observation type, for Sun River North study area, 1986.

Observation Type	Spring	Summer	Fall	Year
Radio Location	33	75	48	156
Sighting	15	10	5	30
Scat	0	3	0	3
Track	13	2	11	26
Other	0	2	0	2
TOTAL	61	92	64	217

Table 8. Number of observations for each season by observation type, for Sun River South study area, 1986.

	Spring	Summer	Fall	Year
Radio Location	51	38	14	103
Sighting	4	1	1	6
Scat	1	0	0	1
Track	10	4	2	16
Other	1	0	0	1
TOTAL	67	43	17	127

Examination of trap site locations indicate the relative proportion of the study area sampled (Figure 12 and 13). Distribution data is poor in areas where trapping and radio relocation efforts have not occurred. Areas needing significant field efforts in order of priority are the Heart Butte area, Deep Creek area, and the North Fork of the Sun River.

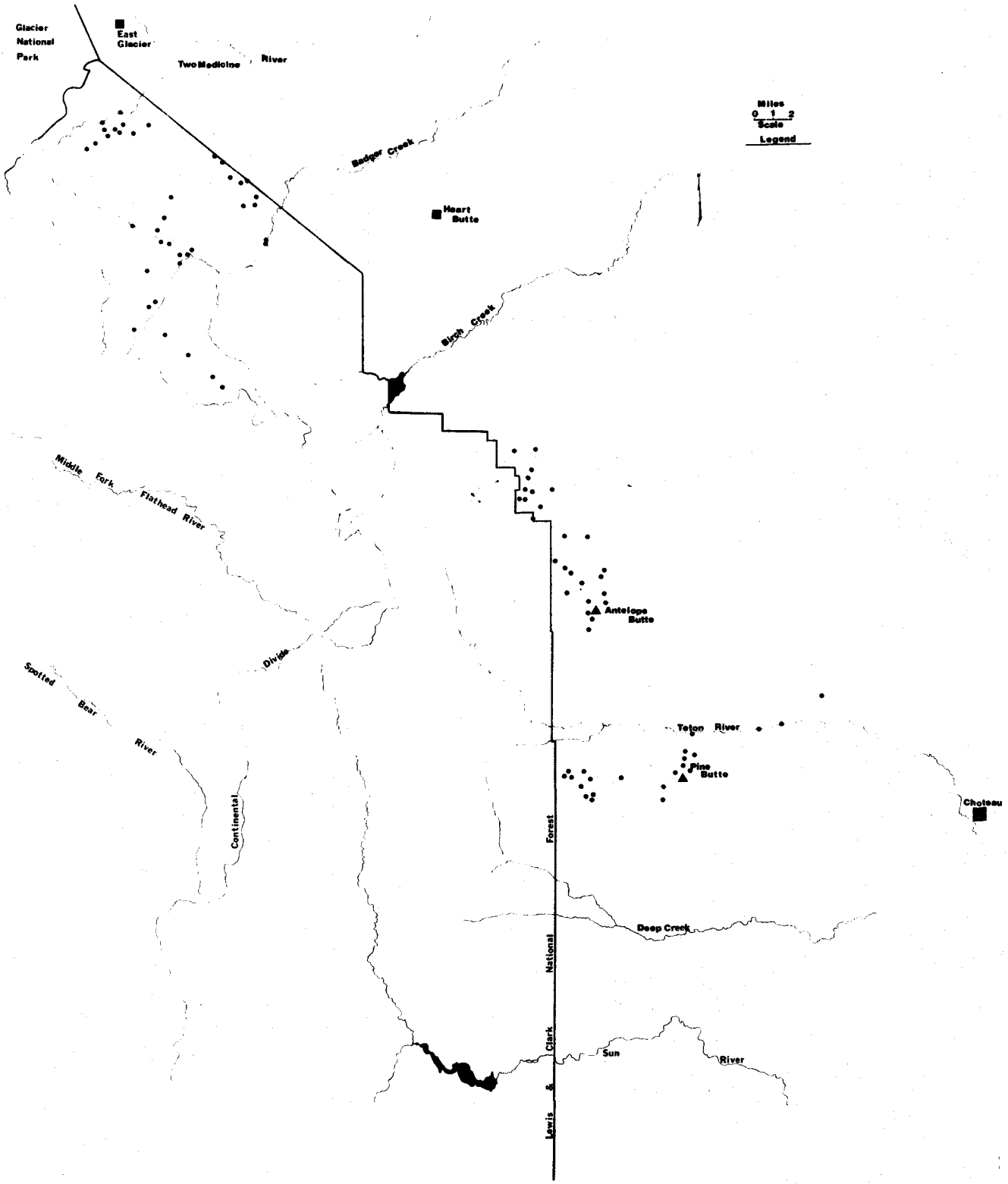

Figure 12. Trap sites north of the Sun River, 1980-86.

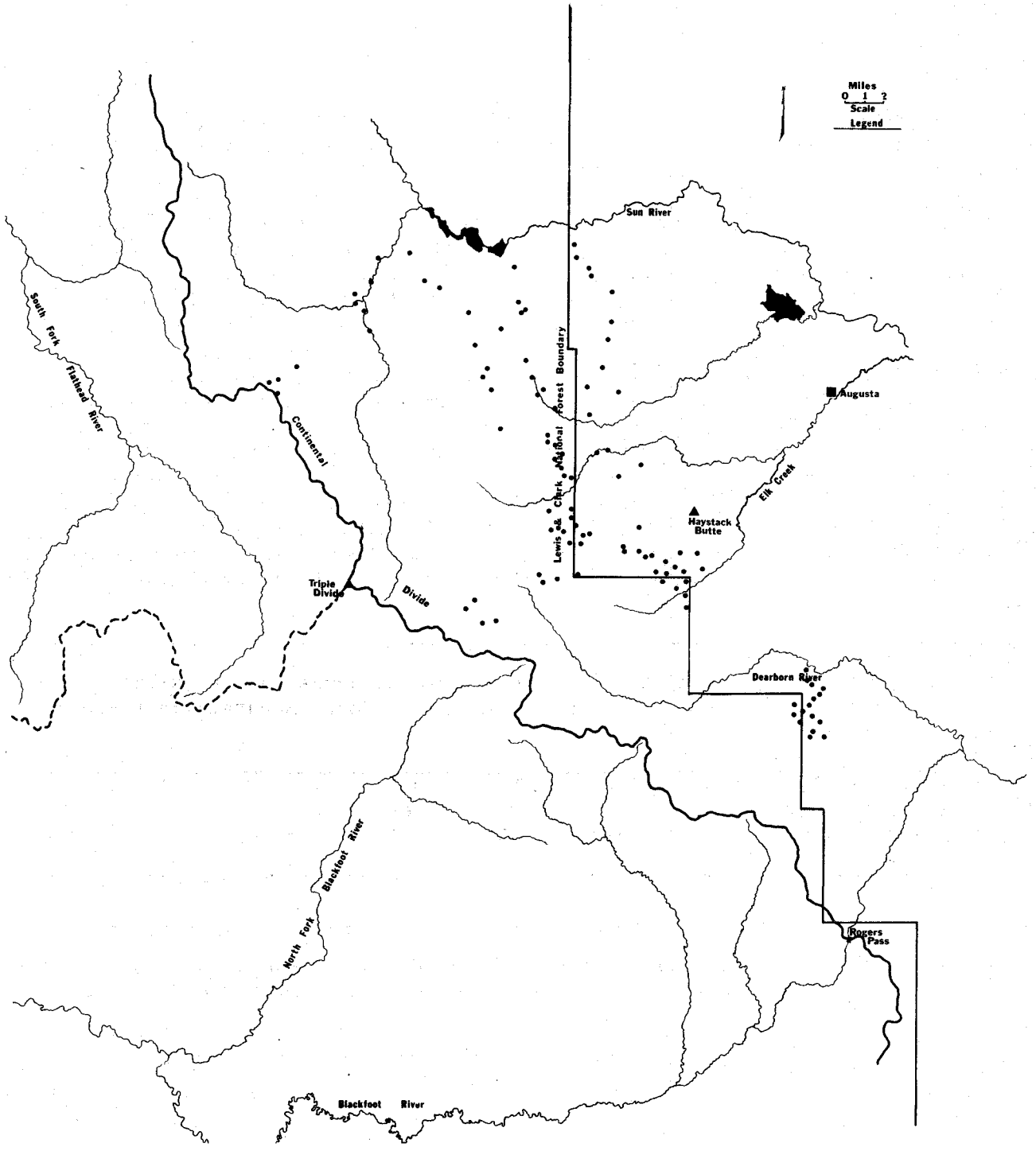

Figure 13. Trap sites south of the Sun River, 1982-86

Observation Records

Data on grizzly bear observations including those from radio relocation were presented in the Distribution discussion above. This section presents the data on observations collected without the aid of radiotelemetry.

From 1980 to 1986, 881 observations of grizzly bears or their sign were recorded. Bears were actually sighted in 312 of these. The type of sign recorded in the remaining records included 280 observations of tracks, 228 of scats, 38 of digs, and 23 observations of other types of sign including dens, hair, marking trees, and evidence of depredation, carrion feeding and predation.

The number of grizzlies observed, either by sighting or from their sign, was determinable for 580 observations. Nine hundred-seven grizzlies or their sign were recorded in observations of from 1 to 7 bears (Table 9). There were 56 records of the sighting or sign of grizzly cubs. The number of cubs recorded per observation was from 1 to 5 and totalled 116 (Table 10). The observation of 5 cubs was an observation in 1982 of 2 adult females with 5 cubs (1 with 2 cubs, 1 with 3 cubs) on Rocky Mountain. There were 40 records of the sighting or sign of yearling litters (yearlings accompanied by an adult female) ranging in size from 1 to 3. The total number of yearlings observed in these litters was 80 (Table 11).

Table 9. Number of observations of grizzly bears by number of bears/observations and total number of bears observed on the Rocky Mountain East Front, 1980-1986.

Number of bears/observation	1	2	3	4	5	7	Total
Number of observations	387	95	68	26	3	1	580
Total number of bears	387	190	204	104	15	7	907

Table 10. Number of observations of grizzly bear cubs by number of cubs/observation and total number of cubs observed on the Rocky Mountain East Front, 1980-1986.

Number of bears/observation	1	2	3	4	5	Total
Number of observations	19	20	12	4	1	56
Total number of cubs	19	40	36	16	5	116

Table 11. Number of observations of litters of yearling grizzly bears by litter size and total number of yearlings on the Rocky Mountain East Front, 1980-1986.

Yearling litter size	1	2	3	Total
Number of observations	11	18	11	40
Total number of yearlings	11	36	33	80

The kinds of activities grizzly bears were recorded doing from the observations records were similar to activities reported for radio collared bears by Aune et al (1984) (Table 12). Bears were sighted most commonly feeding at a carcass, at alpine dig sites, in berry fields, grazing in parks, and while traveling. Bears were rarely observed while bedded or feeding in dense cover types. This is in contrast to activities reported for radio collared grizzlies by Aune et al (1984), where radio collared grizzlies were more commonly bedded and utilizing food resources in timber and shrub plant communities.

Table 12. Activities of grizzly bears from observation records, 1980-86.

Activity	No. obs.	Percent obs.
Feeding Activities		
General feeding	14	2.65
Carcass or Carrion	100	18.56
Grazing	29	5.49
Digging roots	116	21.97
Digging Pine Nuts	20	3.79
Digging small mammals	5	0.95
Tearing logs	1	0.19
Tearing anthills	1	0.19
Turning cowchips + rocks	9	1.70
Turning over litter and duff	1	0.19
Feeding on berries	24	4.55
Anthropogenic foods	29	5.49
Non-feeding Activities		
General	17	3.22
Bedded	17	3.22
Traveling	110	20.83
Mating and courting	16	3.03
Denning-predenning	9	1.70
Wallowing	2	0.38
Playing	3	0.57
	358	100.00

The kinds of habitat components used by grizzlies observed in this study (Table 13) was similar to habitat component use by radio collared grizzlies (Aune et. al. 1986). However a comparison of the percent of observations in each habitat component reveals a difference with the percent of radio locations in each habitat component. Although no test was conducted to compare results statistically, it appears that use of heavy cover types were under represented in the observation records. The use of open habitat components such as Rock/Talus/Scree, mountain grassland, sidehill parks and prairie grassland was probably over represented in the observation records. Forty percent of the observations recorded were in habitat components with little or no cover value. In contrast, 10.8 percent of 1424 radio locations occurred in habitat components with little or no cover (Aune et. al. 1986).

Table 13. Number and percent of observations in each habitat component, 1980-86.

Habitat Component	No. Observations	Percent Observations
Cutting Unit	1	0.12
Meadows	17	2.06
Roads	2	0.24
Sidehill Parks	35	4.01
Snowchutes	6	0.73
Shrubfields	8	0.98
Rock/Talus/Scree	141	16.90
Closed Timber	186	22.38
Open Timber	53	6.32
Limber Pine Savanna	36	4.38
Prairie Grassland	99	11.98
Mountain Grassland	32	3.89
Populus Stand	101	11.92
Riparian Shrub	69	8.27
Riparian Complex	35	4.13
TOTAL	821	100.00

8072/2

The number of observation for each 5 day period from Jan. 1 to Dec. 31, 1980-86 was determined to examine the time period of observation and when bears were most commonly observed (Figure 14). Observation records are prevalent from the second week of March until the last week of November. However, one record for the month of February was available. The record of observations is consistent with data from radio instrumented bears regarding den emergence and den entrance. The largest number of observations by 5 day period was 36 during mid August. This corresponds with the time that radio collared bears were commonly found in open alpine areas digging roots and are thus easily observed.

Home Range

Annual home ranges were mapped and sizes calculated for 9 different grizzly bears monitored during 1986 (Table 14, Figures 15-23). Minimum annual home range size varied from 59.3 to 542.4 sq. km. for female grizzly bears in 1986. Two minimum annual home ranges for males were 599.5 and 805.2 sq. mi. in 1986. Over all years (1980-86) the mean annual minimum home range of adult males was larger than all females ($F=15.62$, $P=0.001$) but was significantly smaller ($F=3.08$, $P=0.10$) than subadult males (Table 15). The mean modified minimum home ranges of adult males and subadult males were not significantly different ($F=0.06$, $P=0.806$). Subadult female and adult female mean annual minimum and mean annual modified minimum home ranges were not significantly different ($F=0.69$, $P=0.41$, $F=0.17$, $P=0.68$). The modified minimum home range of all males was larger ($F=5.84$, P 0.025) than for all females.

Adult bear home ranges are probably a factor of habitat and reproduction. Adult female annual home ranges are more likely driven by habitat conditions with the female strategy to optimize the conversion of energy into progeny. The adult

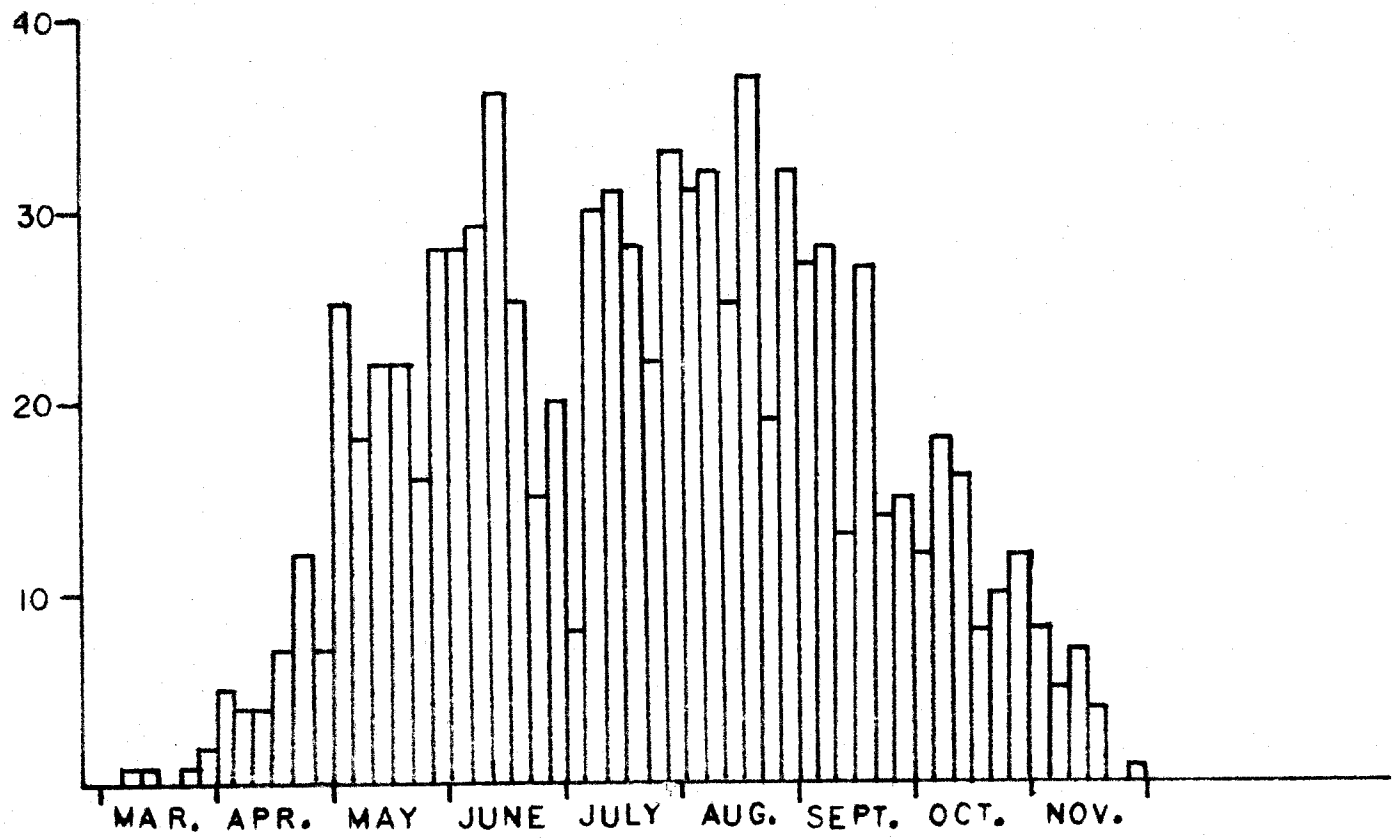

Figure 14. The number of observations recorded per 5 day time periods, March-Nov., 1980-86.

Table 14. Modified minimum and minimum annual home range sizes of grizzly bears, 1984, 1985 and 1986.

			1984 (km^2)		1985 (km^2)		1986 (km^2)	
Bear No.	Sex	Age	Mod. Min.	Min.	Mod. Min.	Min.	Mod. Min.	Min.
335	F	7.5	--	--	--	--	--	435.4
500	F	6.5	91.3	559.3	180.8	621.7	198.9	423.4
313	F	4.5	45.6	195.5	52.9	127.0	144.6	243.5
366	F	5.5	10.9	95.4	60.2	128.9	84.4	190.5
466	F	15.5	--	--	--	--	10.8	59.3
355	M	8.5	84.7	512.61	348.5	831.9	397.7	599.5
301	F	13.5	--	--	117.5	336.6	87.7	317.4
316	F	4.5	--	--	188.1	655.6	446.0	542.4
467	M	3.5	--	--	--	--	168.7	805.2

Table 15. Mean annual home range size of sex and age classes of bears 1980-86.

	Mod. Min. (km^2)			Minimum (km^2)			N
	Mean	S.D.	Range	Mean	S.D.	Range	
Adult Males	238.62	181.07	68.0-456.4	660.83	221.48	388.1-1000.1	6
Adult Females	158.89	90.43	10.8-288.5	382.11	160.59	59.3- 734.6	21
Subadult Males	263.97	191.18	71.6-606.4	1118.43	604.09	441.7-2055.8	8
Subadult Females	143.49	123.19	10.9-446.0	334.07	158.50	95.4- 655.6	12

male strategy for maximizing reproductive output is to include more females in his home range. Subadult males require no larger a portion of habitat annually than adult males (i.e. modified minimum range sizes are similar), but because of large exploratory movements have larger annual minimum home ranges.

Table 16 presents minimum and modified minimum home ranges of bears (includes all years data). A modified minimum home range for subadults was not derived because subadult males dispersed so widely that modified minimum ranges were not considered valid measures of home range. Adult females and subadult females were pooled because no significant difference existed between home range size of these age classes (F=0.17, P=0.68 for modified minimum F=0.69, P=0.41 for minimum).

Aune et al. (1986) hypothesized that grizzly bear home range size may be a function of habitat quality. Jonkel (1982) stated that food and cover are major determinants of home range size and shape. Home ranges should thus be smaller in areas where food and cover (habitat quality) are better. Picton (1983) suggested that climate could predict grizzly bear litter size. This indicates that energy in a temporal sense can effect bear nutritional status. It is also likely that long term climate patterns which vary from place to place can affect long term spatial arrangements of energy. Thus areas with optimal climates for bear foods which can grow in abundance within a small area would result in small home ranges. In contrast areas with less optimal climates for bear foods which cannot grow in abundance in small areas but are more dispersed could result in

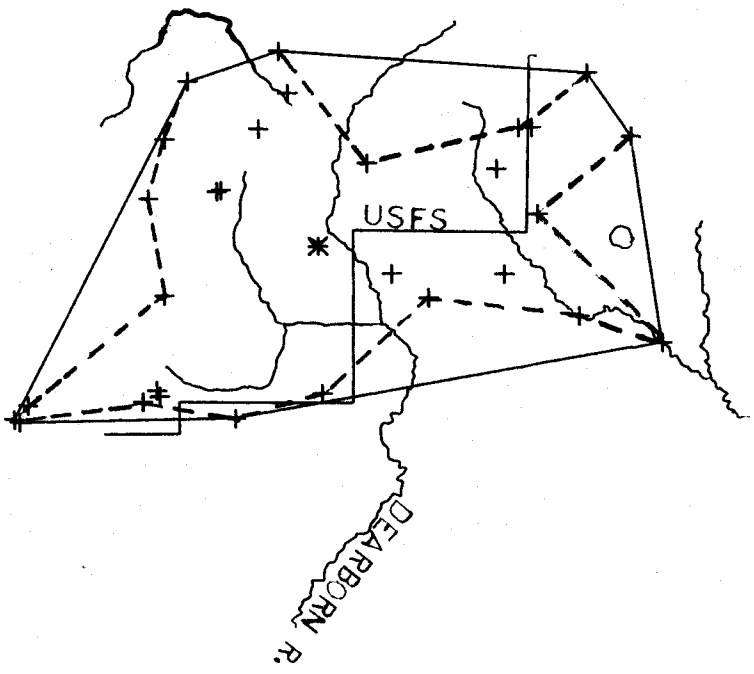

Figure 15. Annual home range of bear 316, 1986.

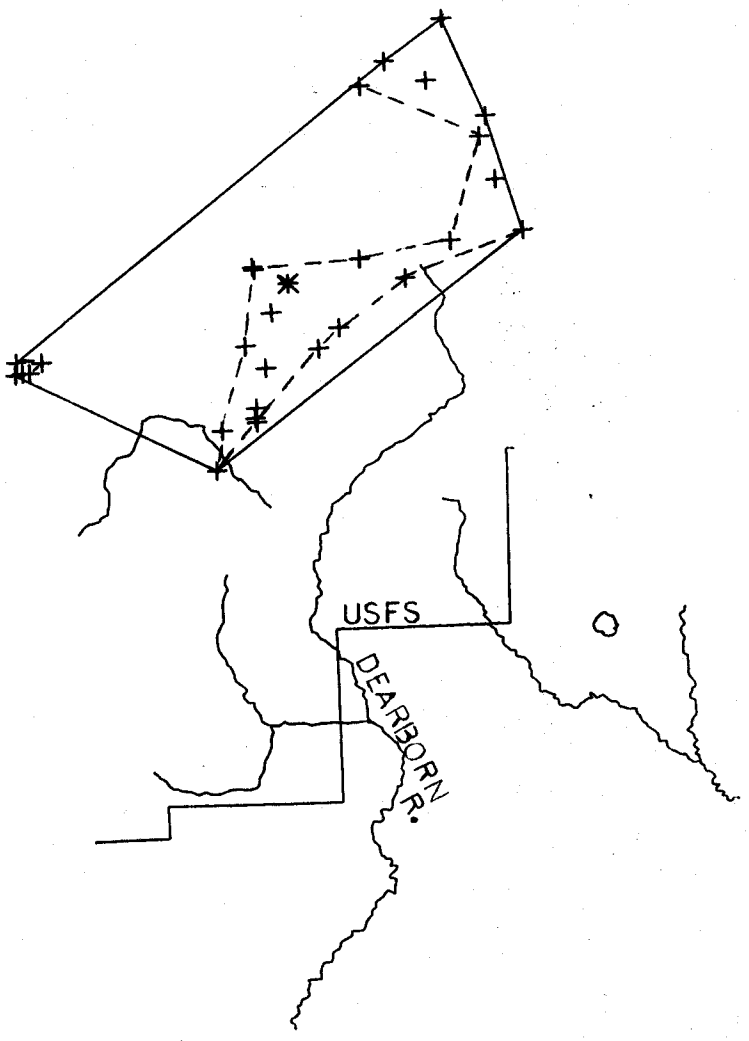

Figure 16. Annual home range of bear 301, 1986.

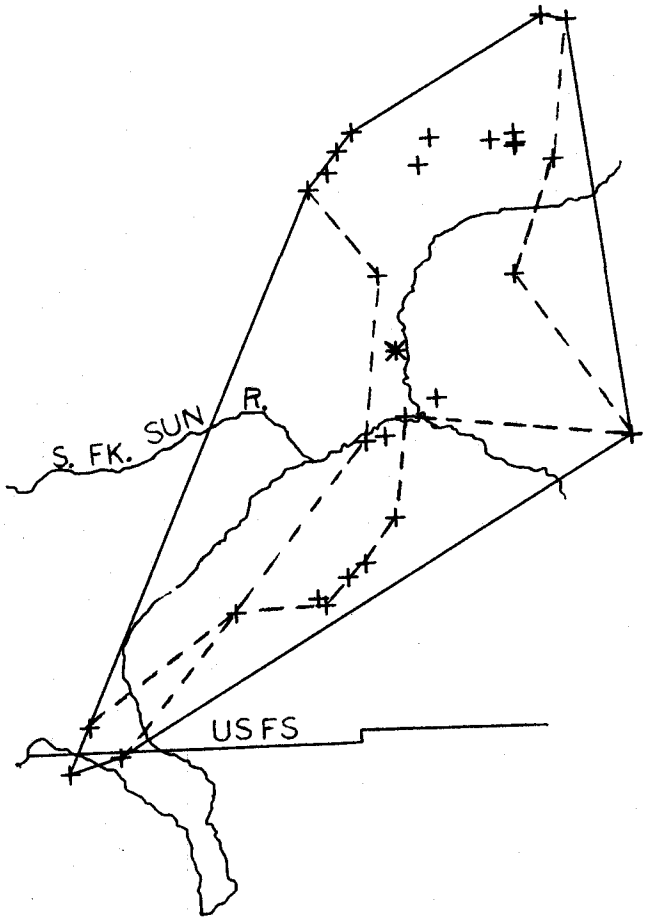

Figure 17. Annual home range of bear 355, 1986.

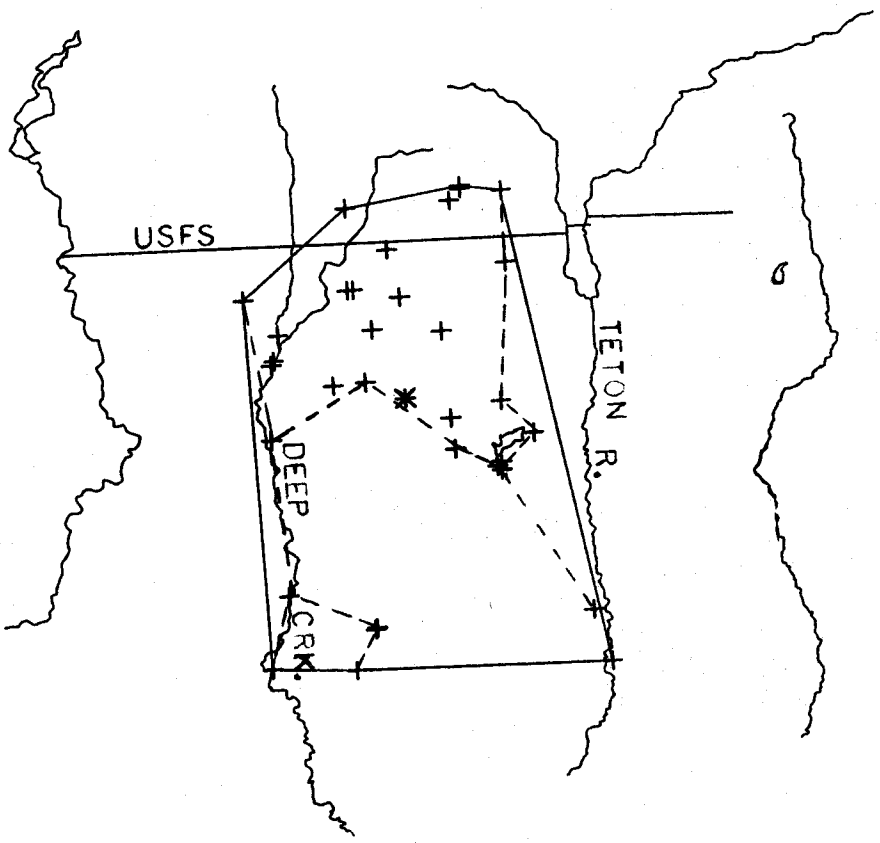

Figure 18. Annual home range of bear 500, 1986.

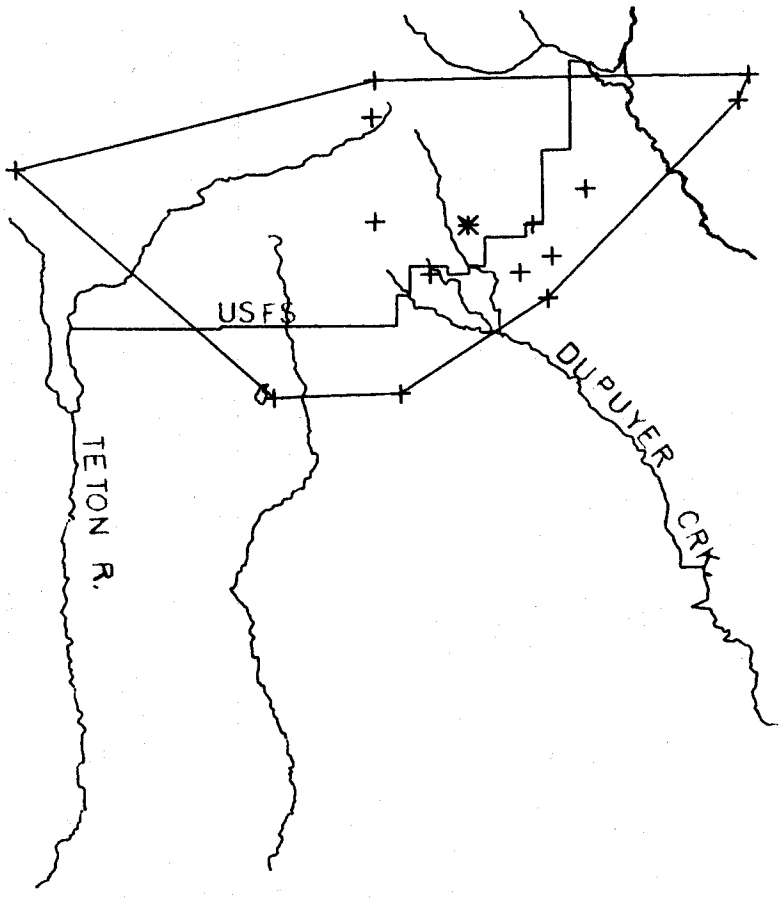

Figure 19. Annual home range of bear 335, 1986.

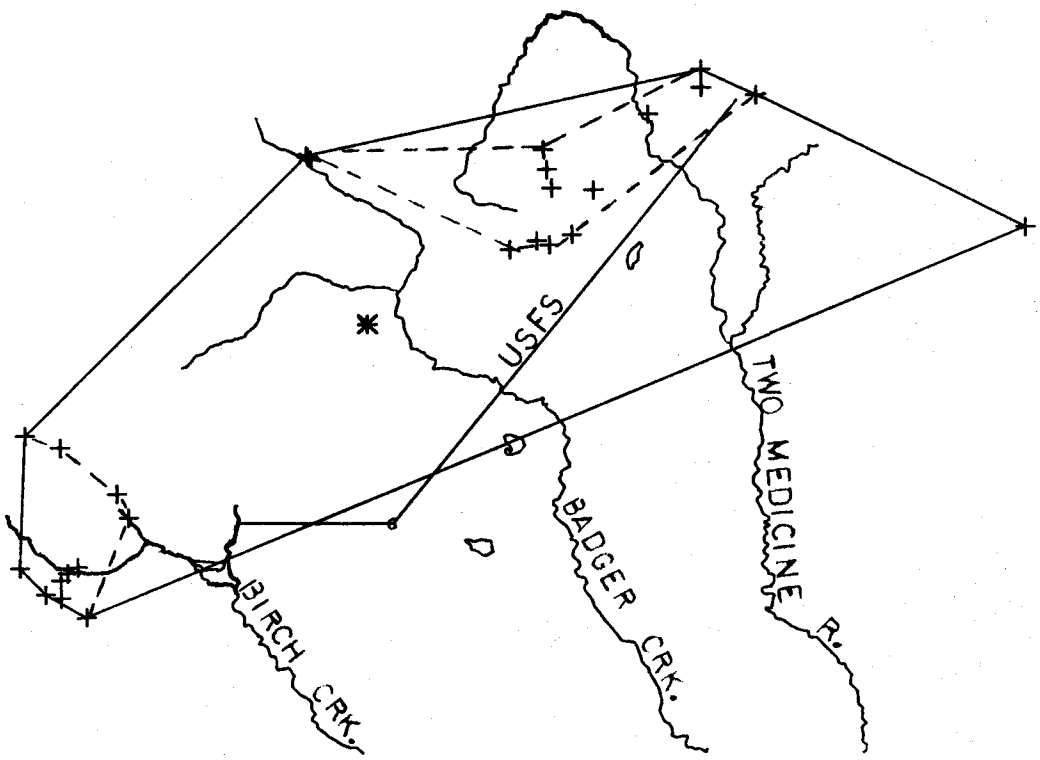

Figure 20. Annual home range of bear 467, 1986.

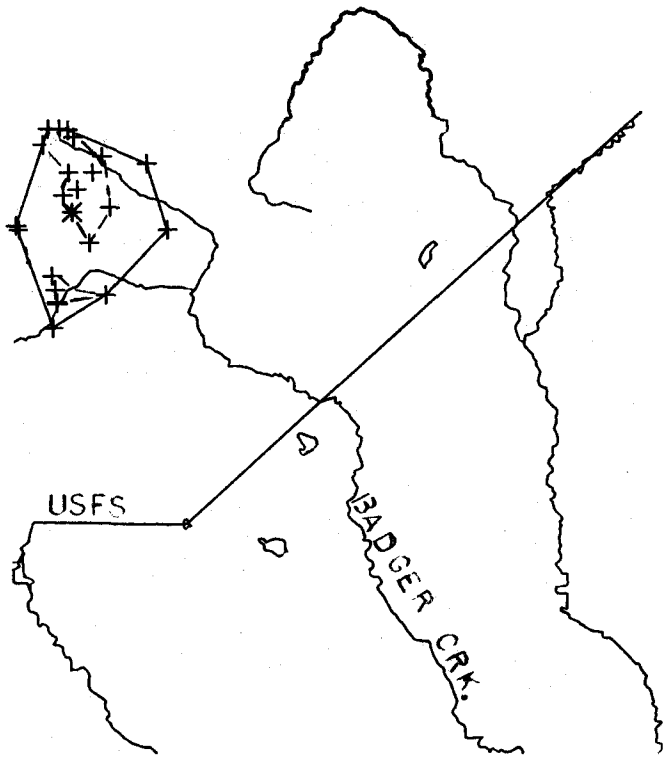

Figure 21. Annual home range of bear 466, 1986.

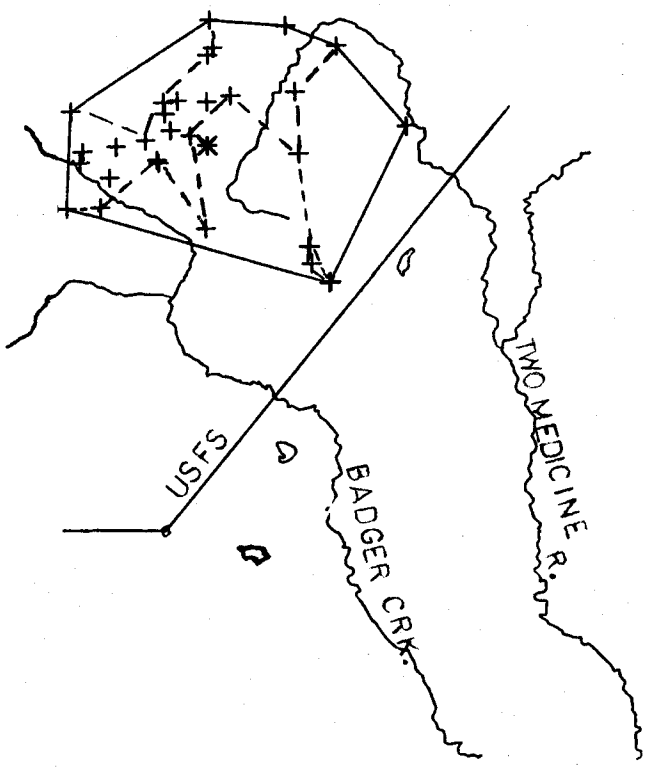

Figure 22. Annual home range of bear 366, 1986.

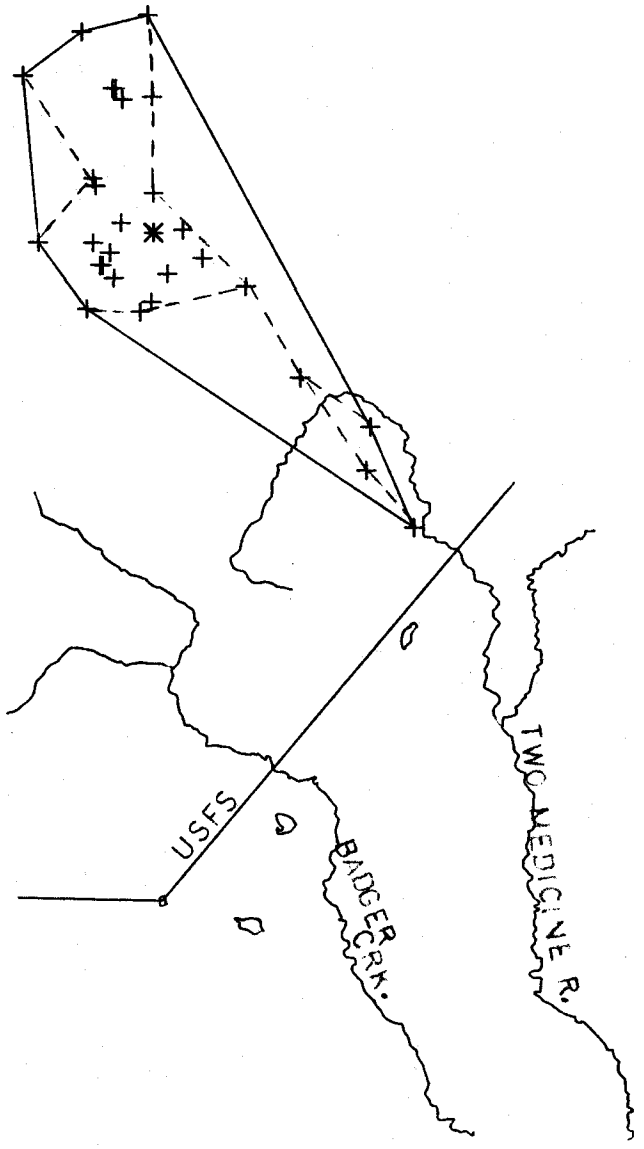

Figure 23. Annual home range of bear 313, 1986.

Table 16. Minimum and modified minimum home ranges of grizzly bears for years combined.

Bear No.	Minimum (km^2)	Modified Minimum (km^2)	No Fixes
Adult Males			
485	873.34	502.99	78
218	661.99	--	38
271	1709.13	1374.70	84
355	1084.45	872.75	94
282	1389.22	1097.73	75
346	1000.04	--	30
229	649.81	--	19
Mean	1052.57	962.04	
S.D.	386.24	368.51	
Subadult Males			
467	805.19	--	27
333	26,672.00	--	93
544	1747.63	--	72
498	2239.50	--	51
328	2300.07	--	41
392	453.81	--	44
529	1366.39	--	35
326	2909.81	--	32
Mean	4811.80		
S.D.	8869.82		
Females			
313	274.13	238.37	92
366	213.36	170.68	100
466	59.34	10.80	23
335	919.50	635.18	143
220	1022.99	713.17	258
548	385.50	257.00	48
273	528.30	342.19	249
301	552.34	342.83	53
500	890.68	496.73	154
317	391.66	195.83	52
518	379.56	257.12	53
316	827.68	512.09	68
Mean	537.09	347.67	
S.D.	310.90	204.89	

larger home ranges. In summary the spatial arrangement of energy available to bears could be largely a factor of climate, in particular precipitation, and would dictate home range size.

In 1986 we examined two gradients in precipitation and the subsequent implication that habitat quality might be reflected in home range size. By dividing the area north and south along a bear management unit boundary we tested home range size in the Badger-Two Medicine Area with home range size south of this management unit. The Badger-Two Medicine Unit has been subjectively labeled higher quality bear habitat due to distribution of foods

and the influence of a moist pacific maritime climate (Aune et al 1986). Weather records substantiate the higher precipitation average for this unit as compared to the BMUs to the south which have drier climates and habitats. A gradient in moisture from east to west is also evident. Here we have used the forest boundary as a divider between bears. Using the geometric activity center of the home range of a bear we classed bears into north or south and east or west classes. An ANOVA was then used to test sex classes of bears by location (Table 17). A distinct difference between home range size in the Badger-Two Medicine BMU and the BMUs to the south is supported for females and both sexes combined. A sample of only one male in the Badger-Two Medicine BMU makes conclusion in regard to males impossible. However in line with the supposition that females home range size is more directly linked to habitat the statistical test is supportive of a difference of habitat influencing home range size. The test between east and west bears in our sample was not conclusive. There was a weak relationship between females home range size west and east of the divide but not a significant one. It is likely that our sample from east to west is not along a large enough gradient to confirm the hypothesis. Home range size of females from west of the divide would be needed to make the sample span the full spectrum of this moisture and habitat gradient.

Table 17. Comparison of home range size between classes of bears along precipitation and habitat gradients, 1980-86.

		Minimum Home Range				Modified Minimum Home Range		
Sex	Class	N	Mean (km^2)	F-Value	Prob.	N	Mean (km^2)	F-Value	Prob.
Males	North	1	873.34	0.22	0.66	1	502.99	0.29	0.62
	South	6	1083.11			5	796.21		
Females	North	3	182.28	9.00	0.01	3	139.95	5.97	0.03
	South	9	655.36			9	416.90		
Both	North	4	355.04	4.90	0.04	4	230.71	2.81	0.11
	South	15	826.46			14	552.37		
Males	West	3	1222.31	1.01	0.36	3	916.81	0.78	0.43
	East	4	926.27			3	577.87		
Females	West	5	403.73	1.67	0.22	5	279.57	0.94	0.35
	East	7	632.34			7	396.30		
Both	West	8	710.70	0.02	0.89	8	518.54	0.15	0.70
	East	11	739.22			10	450.78		

Breeding Areas

Seven individual courtship associations were observed in 1985. Bear pairs were observed in Debrota Creek, Crow Ridge, Smith Creek, Elk Creek, Landers Fork, Crow Creek, and the Two-Medicine Ridge between the dates of May 20 to June 17. Also female bear 366 was located near the capture site of male bear 498 in late June suggesting another possible association. No courtship associations were observed for female bears 500 and 313 in spring, 1986. However, movements of these bears suggest that both may have returned to area's where male bears and breeding activities were observed in previous years. Male bear 355 also returned to an area in which he had encountered females in past years.

Data from 1980-86 has shown that all spring range is used during the breeding season and should be considered breeding area. In addition some female bears appeared to select some remote areas which are not considered spring range, to breed. Bears such as 301, 257, 335 and unmarked females with males 355 and 346 selected high elevation subalpine or alpine areas to mate.

Thirty-seven courtship associations of bears were observed from April 21 to July 15 during the period 1980-86. All but 6 of these courtship associations were recorded by radio telemetry. A total of 56 paired bears were observed in these courtship associations including multiple sightings of a single pair. The peak of pairing and most probably breeding activity is in late May with possibly a second pulse of activity in mid June (Fig. 24).

The observed duration of courtship associations varied from 1 to 19 days. The mean duration of a courtship association resulting in a pair bond was 8.2 days (N=19). In most cases radio monitoring intensity was insufficient to determine the actual duration of the pair bond. Our assumption is that radio monitoring probably underestimated the duration. However in some of the longer cases it is possible that more than one female was in an area and a male bear was associated with more than one bear during the monitoring effort.

Activity Patterns

Activity patterns measured on the Rocky Mountain Front were previously reported (Aune et al (1982, 1983, 1984, and 1986)). Aune et al 1984 discuss the hypothesis that there may be differences in activity patterns between bears in remote areas and bears in areas with high levels of human intrusion. To test this hypothesis we examined East Front bear data from 1979-86.

Activity data were insufficient to test an individual bear within two different settings or during the spring period. However data were sufficient to compare groups of bears during the summer/fall period.

Table 18 presents data from monitoring sessions conducted in 1979-86. Data from 17 monitoring sessions were valid for this test. We had to exclude sessions involving impact monitoring as the influence of disturbances would bias this sample. Sessions were also selected according to the ability to format data according to Garshelis and Pelton (1980) and to include as many different bears as possible.

Table 18. Data from activity monitoring sessions 1979-86.

	No. Bears	No. Sessions	Hours Monitored	Aug Hr/Session
1979	2	2	36.00	18.0
1981	4	15	204.87	13.6
1982	5	11	105.65	9.6
1983	4	11	102.04	9.3
1985	1	2	56.00	28.0
1986	3	5	107.00	21.4
	9	46	611.56	13.3

Ten sessions, involving 152 hours of monitoring on 5 grizzlies, were combined to represent the average activity patterns of lowland bears. Three sessions were included which did not involve monitoring of motion sensitive collars. However these sessions were necessary to give the sample a stronger representation from the daytime period. The data used was biased toward sampling of the dusk to dawn period as monitoring in 1979-83 was primarily directed during the time when bears were active and moving (Table 19). We do not feel that this bias caused a serious problem in this analysis. Most likely daytime activity may be underestimated but the pattern observed was real and matched those observed in monitoring sessions of individuals in this group not included in our analysis.

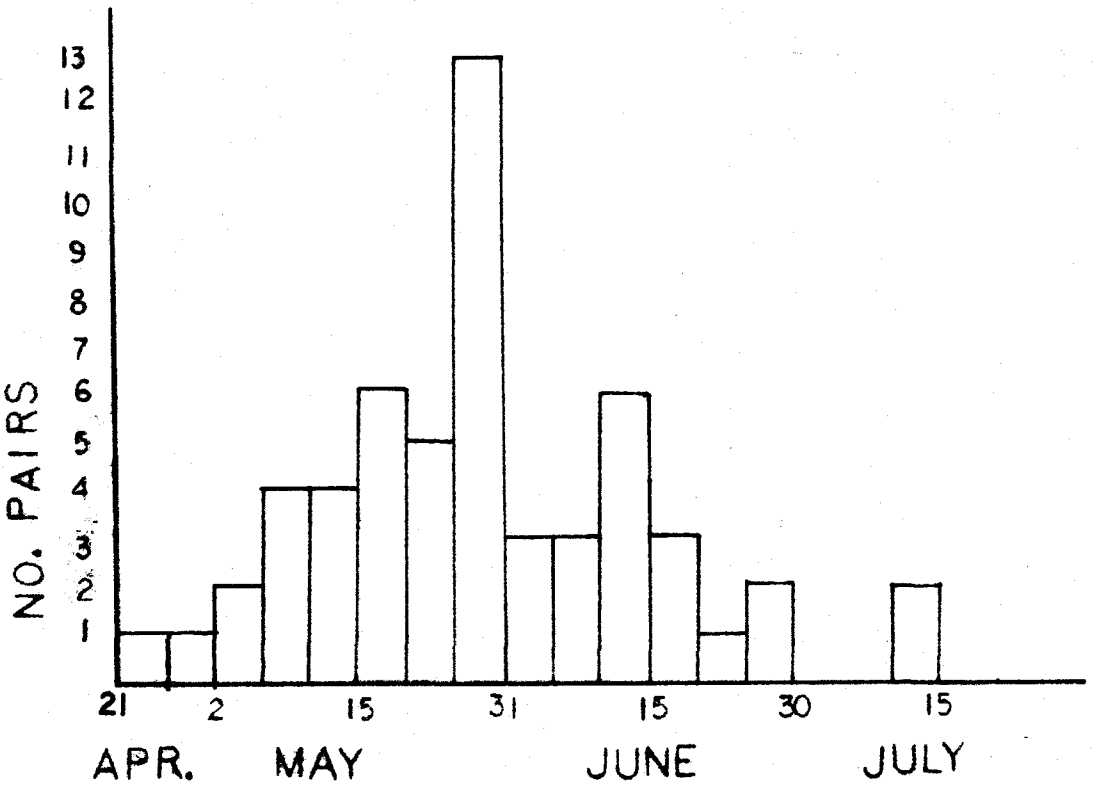

Figure 24. Number of pairs of grizzly bears observed in 5 day time periods April 21-July 15, 1980-86.

Table 19. Hours of monitoring within each 1 hour sampling period, 1979-86.

	No. Hours																								
Backcountry	7	7	7	7	8	8	7	7	6	6	6	6	6	6	7	7	6	6	7	7	7	8	7	7
Lowland	9	9	9	9	9	9	8	7	6	4	2	2	4	3	3	4	4	6	5	6	8	9	9	9
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	Time (hrs)																							

Seven sessions involving 163 hours of monitoring on 3 different grizzlies were used to represent the activity pattern of backcountry bears. All sessions included bears fitted with motion sensitive collars. Sampling was more uniform throughout a 24 hour period within this group (Table 20).

Table 20. Hours and levels of activity for two bear groups on the East Front, 1979-86.

	Actual Hours		Prob. of Activity		
	Mean	In Sample	Mean	S.D.	N
Prob. Activity 50%					
Lowland	13.5	85.5	82.4	13.3	14
Backcountry	12.0	81.5	62.5	6.7	12
	X^2 = .0015		F = 21.25		
Prob. Activity 50%					
Lowland	10.5	66.5	20.0	9.9	10
Backcountry	12.0	81.5	26.9	8.7	12
	X^2 = 1.19		F = 3.24		

Aune and Stivers (1985) discuss the nocturnal habits of grizzly bears along the Rocky Mountain Front lowlands. In the sample of lowland bears a nocturnal activity pattern confirms previous observations (Fig. 25). In general nocturnal patterns have been noted in all bears while utilizing low elevations habitats along the Front (Aune et al 1982, 1983, and 1984). These patterns usually vary in length according to the length of day and temperatures. Activity during the daylight hours in these environments is generally confined to the dusk or dawn hours. Occasional midday feeding bouts in dense secure cover while berries are ripe have been recorded for lowland bears.

In contrast to the lowland bears the average activity pattern of backcountry bears is crepuscular with peaks of activity near 0700 and 1900 hours. The actual activity patterns of individuals was variable. Diurnal, crepuscular and complex patterns of interspersed periods of activity were recorded. In some cases as many as 5 distinct activity peaks occured during one 24 hour monitoring period.

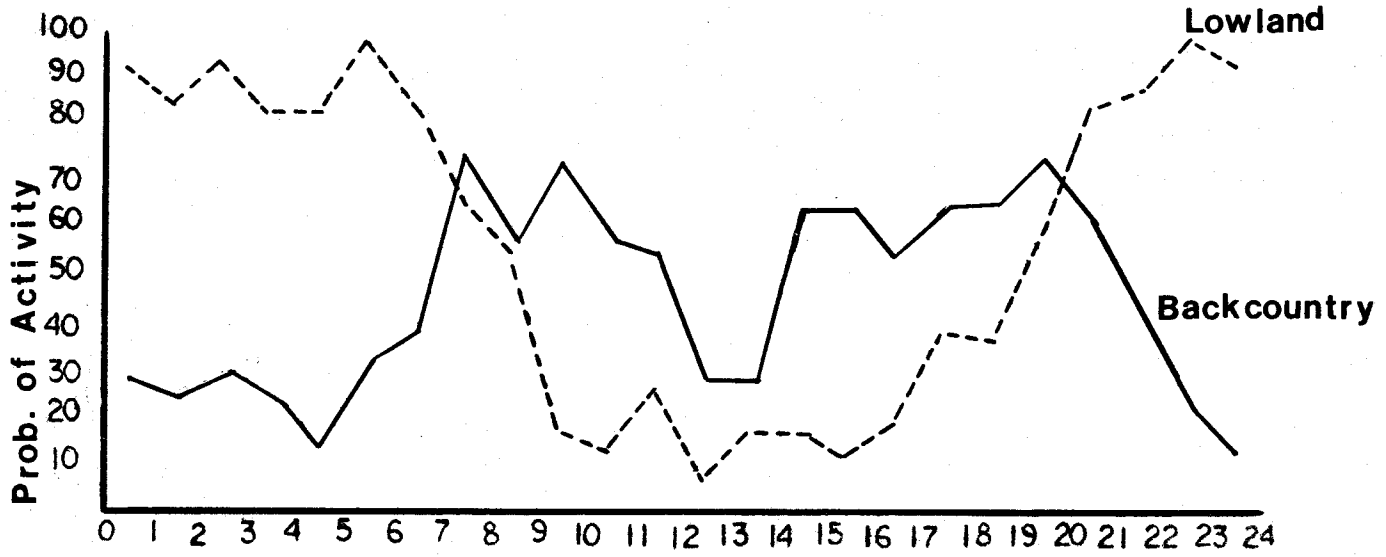

Figure 25. Average activity patterns of lowland and backcountry grizzly bears, 1979-86.

There was no significant difference (P=0.90) in the average hours of vigorous activity between lowland and backcountry bears (Table 20). There was no significant difference (P=0.25) difference in the average hours of moderate activity between lowland and backcountry bears. It appeared that both bear groups spent equal amounts of time engaged in vigorous activities within a 24 hour period, usually 10-15 hours. The average probability of activity of lowland bears was significantly higher (P=0.0001) than backcountry bears during vigorous activity. The average probability of activity was significantly lower (P=0.087) during moderate activity for lowland bears when compared to backcountry bears.

These differences could be a product of the level of human intrusion influencing bears, age and sex of the bear, or differences in habitat and food resources. Schleyer (1983) suggested food, cover, and temperature have major influences on bear activity patterns. Lowland bears on the front were exposed to concentrated food and cover along cool riparian areas in higher temperature environments. They are also exposed to high levels of human intrusion throughout the daylight period. It appears that lowland bears have adopted an activity pattern to accommodate their environment and human competition. Giest (1971) stated that, "mammals learn to minimize encounters with humans if harassed enough by reducing activity to areas, habitats and times of day where encounters with humans are minimal." Grizzly bears along the lowlands of the Rocky Mountain Front are exposed to many forms of harassment throughout the summer-fall period and are hunted during the fall. These pressures over time may have resulted in the evolution of activity patterns from crepuscular toward a nocturnal pattern. Andrews (1979) indicated that shifts in "time territories" may be a mechanism for reducing stress in behavioral interactions. Interactions between bears and humans along the Rocky Mountain Front can be a matter of life and death for either party. The adjustment of "time territories" may be essential for the maintenance of grizzly populations across the Front lowlands.

Further study is needed to determine if adjustments are made in activity patterns during movements to and from the lowlands and backcountry areas by an individual bear. Also further sampling is needed to reinforce data sets thus far analyzed. Information is also needed on the influence of these shifts in activity patterns on energetics of the bear and its ability to access environmental resources.

Food Habits

Bear scats contained food items from 9 major taxonomic groups including; mammals, insects, birds, trees (pine nuts), sporophytes, forbs (including roots and corms), graminoids, shrubs (fruit) and debris (Table 21). Bear food taxon were ranked according to percent frequency and percent volume which may indicate food availability and seasonality (Table 22). Graminoids, forbs, and insects were the most common bear foods along the east front and have high percent frequency values. In contrast seasonally important or less common foods such as fruit, mammals, sporophytes, and pine nuts had low percent frequency values. Graminoids, forbs, and fruit had the highest percent volume of all bear food taxon.

Domestic cattle and deer were the most common mammals eaten both in frequency and volume. Other large herbivores in the diets were domestic sheep, elk, bison, moose, and black bears. The percent frequency and percent volume of

Table 21. Analysis results from 1020 grizzly bear scats from 1979-86.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
0009	Pinus albicaulis	0	7	.69	630.00	.62	90.00	.00	.05
0009	Pinus albicaulis	3	48	4.71	4152.00	4.07	86.50	.19	2.27
	Sub Total		55	5.39	4782.00	4.69	86.95	.25	2.56

0010	Pinus contorta	0	5	.49	119.00	.12	23.80	.00	.01
0010	Pinus contorta	1	2	.20	3.00	.00	1.50	.00	.00
	Sub Total		7	.69	122.00	.12	17.43	.00	.01

0011	Pinus flexilis	0	1	.10	1.00	.00	1.00	.00	.00
0014	Populus tremuloides	0	4	.39	5.00	.00	1.25	.00	.00
0015	Populus trichocarpa	0	2	.20	9.00	.01	4.50	.00	.00
0027	Juniperus horizontalis	3	1	.10	40.00	.04	40.00	.00	.00
0205	Fraxinus	3	1	.10	25.00	.02	25.00	.00	.00
0206	Juniperus	3	1	.10	5.00	.00	5.00	.00	.00
0208	Picea	0	1	.10	2.00	.00	2.00	.00	.00
0209	Pinus	0	10	.98	855.00	.84	85.50	.01	.10
0209	Pinus	3	4	.39	398.00	.39	99.50	.00	.02
	Sub Total		13	1.27	1253.00	1.23	96.38	.02	.16

0210	Populus	0	1	.10	2.00	.00	2.00	.00	.00
0215	Pyrus sp.	3	2	.20	80.00	.08	40.00	.00	.00
0230	Tree	0	2	.20	3.00	.00	1.50	.00	.00
	Total Trees		89	8.73	6329.00	6.20	71.11	.54	1.51

1000	Shrub	0	1	.10	1.00	.00	1.00	.00	.00
1004	Arctostaphylos	0	1	.10	1.00	.00	1.00	.00	.00
1004	Arctostaphylos	1	4	.39	25.00	.02	6.25	.00	.00
1004	Arctostaphylos	3	14	1.37	472.00	.46	33.71	.01	.08
1004	Arctostaphylos	6	7	.69	221.00	.22	31.57	.00	.02
	Sub Total		26	2.55	719.00	.70	27.65	.02	.18

1006	Berberis	1	1	.10	5.00	.00	5.00	.00	.00
1006	Berberis	3	1	.10	40.00	.04	40.00	.00	.00
	Sub Total		2	.20	45.00	.04	22.50	.00	.00

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Table 21. Analysis results from 1020 grizzly bear scats from 1979-86.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
1029	Prunus	0	9	.88	653.00	.64	72.56	.01	.07
1029	Prunus	3	4	.39	335.00	.33	83.75	.00	.02
	Sub Total		13	1.27	988.00	.97	76.00	.01	.13
1031	Rhamnus	0	1	.10	33.00	.03	33.00	.00	.00
1034	Ribes	1	1	.10	5.00	.00	5.00	.00	.00
1034	Ribes	3	2	.20	35.00	.03	17.50	.00	.00
1034	Ribes	6	1	.10	85.00	.08	85.00	.00	.00
	Sub Total		4	.39	125.00	.12	31.25	.00	.00
1035	Rosa	0	11	1.08	460.00	.45	41.82	.00	.06
1035	Rosa	1	1	.10	5.00	.00	5.00	.00	.00
1035	Rosa	3	11	1.08	577.00	.57	52.45	.01	.07
1035	Rosa	6	13	.29	195.00	.19	65.00	.00	.01
	Sub Total		26	2.55	1237.00	1.21	47.58	.03	.31
1039	Shepherdia	6	2	.20	55.00	.05	27.50	.00	.00
1040	Sorbus	3	1	.10	84.00	.08	84.00	.00	.00
1044	Vaccinium	3	1	.10	100.00	.10	100.00	.00	.00
1052	Linnaea	0	1	.10	1.00	.00	1.00	.00	.00
1102	Acer glabrum	6	1	.10	100.00	.10	100.00	.00	.00
1105	Amelanchier alnifolia	0	1	.10	66.00	.06	66.00	.00	.00
1105	Amelanchier alnifolia	3	19	1.86	1245.00	1.22	65.53	.02	.27
1105	Amelancheir alnifolia	6	17	1.67	1364.00	1.34	80.24	.02	.26
	Sub Total		37	3.63	2675.00	2.62	72.30	.10	.96
1109	Cornus stolonifera	0	6	.59	229.00	.22	38.17	.00	.02
1109	Cornus stolonifera	3	9	.88	330.00	.32	36.67	.00	.03
1109	Cornus stolonifera	6	4	.39	285.00	.28	71.25	.00	.01
1109	Cornus stolonifera	7	1	.10	30.00	.03	30.00	.00	.00
	Sub Total		20	1.96	874.00	.86	43.70	.02	.17

Table 21. Analysis results from 1020 grizzly bear scats from 1979-86.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
1110	Crataegus douglasii	3	1	.10	100.00	.10	100.00	.00	.00
1124	Prunus virginiana	0	30	2.94	1718.00	1.68	57.27	.05	.59
1124	Prunus virginiana	2	1	.10	99.00	.10	99.00	.00	.00
1124	Prunus virginiana	3	49	4.80	3282.00	3.22	66.98	.15	1.83
1124	Prunus virginiana	6	3	.29	200.00	.20	66.67	.00	.01
	Sub Total		82	8.04	5299.00	5.20	64.62	.42	4.23
1126	Thamnus alniforia	3	1	.10	27.00	.03	27.00	.00	.00
1138	Sambucjs racemosa	6	1	.10	100.00	.10	100.00	.00	.00
1139	Shepherdia canadensis	0	3	.29	101.00	.10	33.67	.00	.00
1139	Shepherdia canadensis	3	20	1.96	495.00	.49	24.75	.01	.11
1139	Shepherdia canadensis	6	46	4.51	3489.00	3.42	75.85	.15	1.83
1139	Shepherdia canadensis	17	1	.10	100.00	.10	100.00	.00	.00
	Sub Total		70	6.86	4185.00	4.10	59.79	.28	2.85
1146	Vaccinium globulare	3	2	.20	160.00	.16	80.00	.00	.00
1146	Vaccinium globulare	6	12	1.18	1060.00	1.04	88.33	.01	.14
	Sub Total		14	1.37	1220.00	1.20	87.14	.02	.17
1148	Vaccinium scoparium	0	3	.29	5.00	.00	1.67	.00	.00
1148	Vaccinium scoparium	3	1	.10	5.00	.00	5.00	.00	.00
1148	Vaccinium scoparium	6	5	.49	354.00	.35	70.80	.00	.02
	Sub Total		9	.88	364.00	.36	40.44	.00	.03
1159	Ribes montigenum	0	1	.10	97.00	.10	97.00	.00	.00
1186	Vaccinium membranaceum	6	1	.10	100.00	.10	100.00	.00	.00
1187	Shepherdia argentia	3	1	.10	85.00	.08	85.00	.00	.00
1187	Sherpherdia argentia	6	5	.49	270.00	.26	54.00	.00	.02
	Sub Total		6	.59	355.00	.35	59.17	.00	.02
1201	Arctostaphylos uva-ursi	0	15	1.47	318.00	.31	21.20	.00	.05
1201	Arctostaphylos uva-ursi	1	2	.20	31.00	.03	15.50	.00	.00
1201	Arctostaphylos uva-ursi	3	8	.78	390.00	.38	48.75	.00	.04

Table 21. Analysis results from 1020 grizzly bear scats from 1979-86.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
1201	Arctostaphylos uva-ursi	6	8	.78	297.00	.29	37.13	.00	.03
1201	Arctostaphylos uva-ursi	7	1	.10	2.00	.00	2.00	.00	.00
1201	Arctostaphylos uva-ursi	17	1	.10	95.00	.09	95.00	.00	.00
	Sub Total		35	3.43	1133.00	1.11	32.37	.04	.39

1203	Berberis repens	0	1	.10	7.00	.01	7.00	.00	.00
1203	Berberis repens	1	1	.10	28.00	.03	28.00	.00	.00
	Sub Total		2	.20	35.00	.03	17.50	.00	.00

1000	Total Shrubs		308	30.20	20052.00	19.66	65.10	5.94	16.55

2006	Equisetum	0	1	.10	1.00	.00	1.00	.00	.00
2006	Equisetum	1	79	7.75	3227.00	3.16	40.85	.25	2.90
2006	Equisetum	7	1	.10	100.00	.10	100.00	.00	.00
	Sub Total		81	7.94	3328.00	3.26	41.09	.26	2.63

2008	Lycopodium	0	4	.39	9.00	.01	2.25	.00	.00
2049	Puffballs	0	1	.10	10.00	.01	10.00	.00	.00
2053	Mushroom	0	1	.10	4.00	.00	4.00	.00	.00
2054	Lichen	0	1	.10	17.00	.02	17.00	.00	.00
2254	Equisetum arvense	0	8	.78	274.00	.27	34.25	.00	.02
2254	Equisetum arvense	7	1	.10	85.00	.08	85.00	.00	.00
	Sub Total		9	.88	359.00	.35	39.89	.00	.03

	Total Sporophytes		96	9.41	3727.00	3.65	38.82	.34	.96
3000	Graminoid	0	88	8.63	4184.00	4.10	47.55	.35	4.19
3000	Graminoid	1	6	.59	296.00	.29	49.33	.00	.02
	Sub Total		94	9.22	4480.00	4.39	47.66	.40	4.10

3001	Agrapyron	14	2	.20	40.00	.04	20.00	.00	.00
3002	Argrostis	16	1	.10	35.00	.03	35.00	.00	.00
3005	Bromus	14	10	.98	180.00	.18	18.00	.00	.02
3006	Calamagrostis	14	1	.10	35.00	.03	35.00	.00	.00
3006	Calamagrostis	16	1	.10	40.00	.04	40.00	.00	.00
	Sub Total		2	.20	75.00	.07	37.50	.00	.00

8072/2

Table 21. Analysis results from 1020 grizzly bear scats from 1979-86.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
3007	Carex	1	6	.59	190.00	.19	31.67	.00	.01
3007	Carex	6	17	1.67	620.00	.61	36.47	.01	.12
3007	Carex	7	3	.29	125.00	.12	41.67	.00	.00
3007	Carex	14	5	.49	110.00	.11	22.00	.00	.01
3007	Carex	16	1	.10	15.00	.01	15.00	.00	.00
3007	Carex	17	1	.10	90.00	.09	90.00	.00	.00
	Sub Total		33	3.24	1150.00	1.13	34.85	.04	.37
3013	Festuca	0	2	.20	101.00	.10	50.50	.00	.00
3013	Festuca	14	4	.39	119.00	.12	29.75	.00	.01
	Sub Total		6	.59	220.00	.22	36.67	.00	.01
3014	Glyceria	22	1	.10	20.00	.02	20.00	.00	.00
3016	Juncus	14	1	.10	50.00	.05	50.00	.00	.00
3019	Melica	4	1	.10	5.00	.00	5.00	.00	.00
3019	Melica	17	1	.10	5.00	.00	5.00	.00	.00
	Sub Total		2	.20	10.00	.01	5.00	.00	.00
3023	Poa	1	42	4.12	1200.00	1.18	28.57	.05	.57
3023	Poa	7	4	.39	130.00	.13	32.50	.00	.01
3023	Poa	13	1	.10	10.00	.01	10.00	.00	.00
3023	Poa	14	29	2.84	829.00	.81	28.59	.02	.27
	Sub Total		76	7.45	2169.00	2.13	28.54	.16	1.61
3031	Scirpus	14	5	.49	170.00	.17	34.00	.00	.01
3034	Triticum	3	1	.10	10.00	.01	10.00	.00	.00
3034	Triticum	6	1	.10	25.00	.02	25.00	.00	.00
3034	Triticum	17	1	.10	60.00	.06	60.00	.00	.00
	Sub Total		3	.29	95.00	.09	31.67	.00	.00
3100	Grass	1	5	.49	310.00	.30	62.00	.00	.02
3102	Grass/Sedge	0	6	.59	360.00	.35	60.00	.00	.02
3102	Grass/Sedge	1	293	28.73	12747.00	12.50	43.51	3.59	42.48
3102	Grass/Sedge	4	1	.10	30.00	.03	30.00	.00	.00

Table 21. Analysis results from 1020 grizzly bear scats from 1979-86.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
3102	Grass/Sedge	6	1	.10	70.00	.07	70.00	.00	.00
3102	Grass/Sedge	7	31	3.04	1543.00	1.51	49.77	.05	.54
	Sub Total		332	32.55	14750.00	14.46	44.43	4.71	47.70

3337	Bromus anomalus	14	1	.10	60.00	.06	60.00	.00	.00
3344	Carex scopulorum	16	1	.10	40.00	.04	40.00	.00	.00
3351	Phleum alpinum	14	2	.20	39.00	.04	19.50	.00	.00
3414	Phleum pratense	14	3	.29	130.00	.13	43.33	.00	.00
3442	Avena sativa	3	17	1.67	1084.00	1.06	63.76	.02	.21
3442	Avena sativa	6	5	.49	355.00	.35	71.00	.00	.02
3442	Avena sativa	14	1	.10	30.00	.03	30.00	.00	.00
3442	Avena sativa	19	1	.10	65.00	.06	65.00	.00	.00
	Sub Total		24	2.35	1534.00	1.50	63.92	.04	.36

	Total Graminoids		564	55.29	25557.00	25.06	45.31	13.85	38.63

4000	Forb	0	5	.49	7.00	.01	1.40	.00	.00
4000	Forb	1	36	3.53	659.00	.65	18.31	.02	.27
4000	Forb	4	5	.49	228.00	.22	45.60	.00	.01
	Sub Total		46	4.51	894.00	.88	19.43	.04	.40

4011	Angelica	1	6	.59	155.00	.15	25.83	.00	.01
4011	Angelica	6	1	.10	60.00	.06	60.00	.00	.00
	Sub Total		7	.69	215.00	.21	30.71	.00	.01

4041	Cirsium	1	11	1.08	375.00	.37	34.09	.00	.05
4041	Cirsium	14	2	.20	45.00	.04	22.50	.00	.00
	Sub Total		13	1.27	420.00	.41	32.31	.01	.05

4043	Claytonia	0	1	.10	35.00	.03	35.00	.00	.00
4048	Comandra	4	1	.10	10.00	.01	10.00	.00	.00
4051	Cornus	0	1	.10	45.00	.04	45.00	.00	.00
4065	Erigeron	1	1	.10	2.00	.00	2.00	.00	.00
4066	Eriogonum	0	1	.10	2.00	.00	2.00	.00	.00

Table 21. Analysis results from 1020 grizzly bear scats from 1979-86.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
4084	Hedysarum	1	1	.10	9.00	.01	9.00	.00	.00
4084	Hedysarum	4	10	.98	935.00	.92	93.50	.01	.00
	Sub Total		11	1.08	944.00	.93	85.82	.01	.10

4088	Heracleum	1	4	.39	110.00	.11	27.50	.00	.01
4088	Heracleum	4	6	.59	350.00	.34	58.33	.00	.02
4088	Heracleum	6	1	.10	75.00	.07	75.00	.00	.00
4088	Heracleum	7	2	.20	100.00	.10	50.00	.00	.00
	Sub Total		13	1.27	635.00	.62	48.85	.01	.08

4100	Lathyrus	1	32	3.14	853.00	.84	26.66	.03	.31
4100	Lathyrus	11	1	.10	10.00	.01	10.00	.00	.00
	Sub Total		33	3.24	863.00	.85	26.15	.03	.28

4102	Ligusticum	14	1	.10	20.00	.02	20.00	.00	.00
4107	Lithophragma	10	1	.10	70.00	.07	70.00	.00	.00
4109	Lomatium	0	2	.20	142.00	.14	71.00	.00	.00
4109	Lomatium	4	6	.59	355.00	.35	59.17	.00	.02
4109	Lomatium	7	4	.39	240.00	.24	60.00	.00	.01
	Sub Total		12	1.18	737.00	.72	61.42	.01	.09

4114	Melilotus	3	1	.10	20.00	.02	20.00	.00	.00
4120	Mitella	1	1	.10	2.00	.00	2.00	.00	.00
4131	Osmorhiza	1	19	1.86	1274.00	1.25	67.05	.02	.28
4131	Osmorhiza	4	1	.10	70.00	.07	70.00	.00	.00
4131	Osmorhiza	7	4	.39	240.00	.24	60.00	.00	.01
4131	Osmorhiza	14	2	.20	190.00	.19	95.00	.00	.00
	Sub Total		26	2.55	1774.00	1.74	68.23	.04	.45

4142	Polygonum	1	1	.10	25.00	.02	25.00	.00	.00
4142	Polygonum	3	1	.10	1.00	.00	1.00	.00	.00
4142	Polygonum	6	1	.10	10.00	.01	10.00	.00	.00
	Sub Total		3	.29	36.00	.04	12.00	.00	.00

Table 21. Analysis results from 1020 grizzly bear scats from 1979-86.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
4150	Ranunculus	0	1	.10	5.00	.00	5.00	.00	.00
4171	Taraxacum	0	5	.49	66.00	.06	13.20	.00	.00
4171	Taraxacum	3	4	1.27	385.00	.38	29.62	.00	.06
4171	Taraxacum	6	11	1.08	730.00	.72	66.36	.01	.09
4171	Taraxacum	7	8	.78	550.00	.54	68.75	.00	.05
4171	Taraxacum	10	1	.10	50.00	.05	50.00	.00	.00
4171	Taraxacum	13	1	.10	20.00	.02	20.00	.00	.00
4171	Taraxacum	14	52	5.10	2331.00	2.29	44.83	.12	1.38
4171	Taraxacum	15	7	.69	475.00	.47	67.86	.00	.04
4171	Taraxacum	16	13	1.27	785.00	.77	60.38	.01	.12
4171	Taraxacum	17	9	.88	690.00	.68	76.67	.01	.07
4171	Taraxacum	19	2	.20	75.00	.07	37.50	.00	.00
	Sub Total		126	12.35	6249.00	6.13	49.60	.76	7.67
4177	Tragopogon	6	2	.20	160.00	.16	80.00	.00	.00
4180	Trifolium	0	9	.88	179.00	.18	19.89	.00	.02
4180	Trifolium	1	18	1.76	310.00	.30	17.22	.01	.06
4180	Trifolium	14	1	.10	25.00	.02	25.00	.00	.00
	Sub Total		28	2.75	514.00	.50	18.36	.01	.14
4184	Valeriana	1	1	.10	20.00	.02	20.00	.00	.00
4188	Vicia	1	1	.10	10.00	.01	10.00	.00	.00
4301	Centaurea	13	2	.20	10.00	.01	5.00	.00	.00
4301	Centaurea	14	1	.10	15.00	.01	15.00	.00	.00
	Sub Total		3	.29	25.00	.02	8.33	.00	.00
4302	Cerastium	0	1	.10	10.00	.01	10.00	.00	.00
4302	Cerastium	14	1	.10	2.00	.00	2.00	.00	.00
	Sub Total		2	.20	12.00	.01	6.00	.00	.00
4303	Viburnum	3	1	.10	30.00	.03	30.00	.00	.00
4351	Compositae-Asteraceae	18	1	.10	80.00	.08	80.00	.00	.00
4352	Leguminosae-Fabaceae	1	1	.10	80.00	.08	80.00	.00	.00
4353	Umbelliferae-Apiaceae	1	24	2.35	910.00	.89	37.92	.02	.25

Table 21. Analysis results from 1020 grizzly bear scats from 1979-86.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
4353	Umbelliferae-Apiaceae	4	4	.39	200.00	.20	50.00	.00	.01
4353	Umbelliferae-Apiaceae	7	4	.39	205.00	.20	51.25	.00	.01
	Sub Total		32	3.14	1315.00	1.29	41.09	.04	.41

4356	Lilicaceae	1	3	.29	6.00	.01	2.00	.00	.00
4408	Anelica arguta	14	1	.10	80.00	.08	80.00	.00	.00
4446	Claytonia lanceolata	14	1	.10	10.00	.01	10.00	.00	.00
4460	Erigeron divergens	7	1	.10	60.00	.06	60.00	.00	.00
4481	Heracleum lanatum	0	4	.39	205.00	.20	51.25	.00	.01
4481	Heracleum lanatum	1	32	3.14	2215.00	2.17	69.22	.07	.81
	Sub Total		36	3.53	2420.00	2.37	67.22	.08	.85

4482	Heuchera cylindrica	1	3	.29	55.00	.05	18.33	.00	.00
4489	Ligusticum canbyi	1	1	.10	100.00	.10	100.00	.00	.00
4553	Vicia americana	1	1	.10	15.00	.01	15.00	.00	.00
4596	Cirsium scariosum	14	1	.10	20.00	.02	20.00	.00	.00
	Sub Total		4	.39	195.00	.19	48.75	.00	.01

4640	Lomatium cous	4	2	.20	91.00	.09	45.50	.00	.00
4640	Lomatium cous	7	7	.69	485.00	.48	69.29	.00	.04
4640	Lomatium cous	16	1	.10	65.00	.06	65.00	.00	.00
	Sub Total		10	.98	641.00	.63	64.10	.01	.06

4771	Clatonia megarhiza	4	9	.88	740.00	.73	82.22	.01	.08
4771	Clatonia megarhiza	7	1	.10	30.00	.03	30.00	.00	.00
	Sub Total		10	.98	770.00	.75	77.00	.01	.08

4991	Taraxacum officinale	0	2	.20	49.00	.05	24.50	.00	.00
4991	Taraxacum officinale	1	3	.29	115.00	.11	38.33	.00	.00
4991	Taraxacum officinale	6	3	.29	185.00	.18	61.67	.00	.01
4991	Taraxacum officinale	14	8	.78	380.00	.37	47.50	.00	.03
4991	Taraxacum officinale	16	2	.20	95.00	.09	47.50	.00	.00
4991	Taraxacum officinale	17	3	.29	185.00	.18	61.67	.00	.01
	Sub Total		21	2.06	1009.00	.99	48.05	.02	.21

Table 21. Analysis results from 1020 grizzly bear scats from 1979-86.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
4999	Veronica biloba	14	1	.10	20.00	.02	20.00	.00	.00
	Total Forbs		370	36.27	20605.00	20.20	55.69	7.33	20.43
6001	Meat-Unident	0	8	.78	39.00	.04	4.88	.00	.00
6001	Meat-Unident	21	1	.10	100.00	.10	100.00	.00	.00
6001	Meat-Unident	22	1	.10	10.00	.01	10.00	.00	.00
6001	Meat-Unident	30	2	.20	70.00	.07	35.00	.00	.00
	Sub Total		12	1.18	219.00	.21	18.25	.00	.03
6002	Large Mammal-Unident	0	5	.49	87.00	.09	17.40	.00	.00
6002	Large Mammal-Unident	21	7	.69	110.00	.11	15.71	.00	.01
6002	Large Mammal-Unident	22	8	.78	142.00	.14	17.75	.00	.01
6002	Large Mammal-Unident	23	9	.88	150.00	.15	16.67	.00	.02
6002	Large Mammal-Unident	27	3	.29	80.00	.08	26.67	.00	.00
6002	Large Mammal-Unident	30	5	.49	240.00	.24	48.00	.00	.01
6002	Large Mammal-Unident	37	3	.29	85.00	.08	28.33	.00	.00
	Sub Total		40	3.92	894.00	.88	22.35	.03	.35
6003	Elk	22	6	.59	290.00	.28	48.33	.00	.02
6003	Elk	30	4	.39	245.00	.24	61.25	.00	.01
6003	Elk	37	1	.10	60.00	.06	60.00	.00	.00
	Sub Total		11	1.08	595.00	.58	54.09	.01	.06
6004	Bison	30	1	.10	90.00	.09	90.00	.00	.00
6005	Sheep-Domestic	22	1	.10	35.00	.03	35.00	.00	.00
6005	Sheep-Domestic	26	2	.20	65.00	.06	32.50	.00	.01
6005	Sheep-Domestic	30	3	.29	225.00	.22	75.00	.00	.01
6005	Sheep-Domestic	32	1	.10	40.00	.04	40.00	.00	.00
	Sub Total		8	.78	465.00	.46	58.13	.00	.04
6006	Rodent	0	2	.20	13.00	.01	6.50	.00	.00
6007	Pocket Gopher	33	1	.10	25.00	.02	25.00	.00	.00
6008	Microtus	30	1	.10	15.00	.01	15.00	.00	.00
6008	Microtus	31	1	.10	5.00	.00	5.00	.00	.00
	Sub Total		2	.20	20.00	.02	10.00	.00	.00

Table 21. Analysis results from 1020 grizzly bear scats from 1979-86.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
6009	Deer	0	3	.29	95.00	.09	31.67	.00	.00
6009	Deer	22	12	1.18	248.00	.24	20.67	.00	.03
6009	Deer	26	6	.59	275.00	.27	45.83	.00	.02
6009	Deer	30	18	1.76	810.00	.79	45.00	.01	.17
6009	Deer	32	1	.10	20.00	.02	20.00	.00	.00
6009	Deer	36	1	.10	45.00	.04	45.00	.00	.00
6009	Deer	37	5	.49	200.00	.20	40.00	.00	.01
	Sub Total		46	4.51	1693.00	1.66	36.80	.07	.76
6012	Marmot	0	1	.10	9.00	.01	9.00	.00	.00
6012	Marmot	22	1	.10	15.00	.01	15.00	.00	.00
6012	Marmot	38	1	.10	50.00	.05	50.00	.00	.00
	Sub Total		3	.29	74.00	.07	24.67	.00	.00
6013	Moose (Alces alces)	30	1	.10	50.00	.05	50.00	.00	.00
6014	Demestic Cattle	0	8	.78	205.00	.20	25.63	.00	.02
6014	Demestic Cattle	22	35	3.43	651.00	.64	18.60	.02	.26
6014	Demestic Cattle	26	19	1.86	870.00	.85	45.79	.02	.19
6014	Demestic Cattle	27	1	.10	10.00	.01	10.00	.00	.00
6014	Demestic Cattle	30	38	3.73	1486.00	1.46	39.11	.05	.64
6014	Demestic Cattle	37	15	1.47	1005.00	.99	67.00	.01	.17
	Sub Total		116	11.37	4227.00	4.14	36.44	.47	4.78
6016	Grizzly	0	4	.39	4.00	.00	1.00	.00	.00
6016	Grizzly	22	1	.10	90.00	.09	90.00	.00	.00
	Sub Total		5	.49	94.00	.09	18.80	.00	.00
6017	Black Bear	22	1	.10	90.00	.09	90.00	.00	.00
6019	Horse	30	1	.10	70.00	.07	70.00	.00	.00
6020	Lagomorph	22	1	.10	10.00	.01	10.00	.00	.00
6020	Lagomorph	30	1	.10	70.00	.07	70.00	.00	.00
6020	Lagomorph	32	1	.10	15.00	.01	15.00	.00	.00
	Sub Total		3	.29	95.00	.09	31.67	.00	.00

8072/2

Table 21. Analysis results from 1020 grizzly bear scats from 1979-86.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
6022	Small Mammal-Unid	23	4	.39	45.00	.04	11.25	.00	.00
6022	Small Mammal-Unid	25	1	.10	1.00	.00	1.00	.00	.00
6022	Small Mammal-Unid	30	1	.10	15.00	.01	15.00	.00	.00
	Sub Total		6	.59	61.00	.06	10.17	.00	.00
6023	Spermophilus-citellus	0	1	.10	4.00	.00	4.00	.00	.00
6023	Spermophilus-citellus	22	2	.20	9.00	.01	4.50	.00	.00
6023	Spermophilus-citellus	25	1	.10	39.00	.04	39.00	.00	.00
6023	Spermophilus-citellus	30	2	.20	6.00	.01	3.00	.00	.00
6023	Spermophilus-citellus	32	2	.20	30.00	.03	15.00	.00	.00
	Sub Total		8	.78	88.00	.09	11.00	.00	.01
6026	Microtinae	0	2	.20	2.00	.00	1.00	.00	.00
6026	Microtinae	30	2	.20	35.00	.03	17.50	.00	.00
	Sub Total		4	.39	37.00	.04	9.25	.00	.00
6001	Total Mammals		256	25.10	8900.00	8.73	34.77	2.19	6.11
6301	Unknown Insect	0	3	.29	48.00	.05	16.00	.00	.00
6302	Ant	0	294	28.82	4872.00	4.78	16.57	1.38	16.29
6302	Ant	1	1	.10	5.00	.00	5.00	.00	.00
6302	Ant	3	1	.10	3.00	.00	3.00	.00	.00
	Sub Total		296	29.02	4880.00	4.78	16.49	1.39	14.07
6303	Larva	0	2	.20	35.00	.03	17.50	.00	.00
6304	Bee	0	6	.59	64.00	.06	10.67	.00	.00
6305	Grasshopper	0	1	.10	1.00	.00	1.00	.00	.00
6306	Vespidae Wasp	0	4	.39	54.00	.05	13.50	.00	.00
6307	Moths	0	15	1.47	1015.00	1.00	67.67	.01	.17
6308	Coleoptera	0	9	.88	25.00	.02	2.78	.00	.00
	Total Insects		326	31.96	6122.00	6.00	18.78	1.92	5.35
6601	Unidentified Bird	0	2	.20	11.00	.01	5.50	.00	.00
6601	Unidentified Bird	41	6	.59	19.00	.02	3.17	.00	.00
	Sub Total		8	.78	30.00	.03	3.75	.00	.00

Table 21. Analysis results from 1020 grizzly bear scats from 1979-86.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %

6602	Grouse	0	1	.10	2.00	.00	2.00	.00	.00
	Total Birds		9	.88	32.00	.03	3.56	.00	.00

6702	Plastic	0	1	.10	3.00	.00	3.00	.00	.00
6703	Paper	0	1	.10	37.00	.04	37.00	.00	.00
6704	Tin Foil	0	1	.10	1.00	.00	1.00	.00	.00
6708	Eggs	0	1	.10	5.00	.00	5.00	.00	.00
	Total Garbage		4	.39	46.00	.05	11.50	.00	.00

6801	Debris	0	178	17.45	4516.00	4.43	25.37	.77	9.14
6802	Wood	0	62	6.08	1005.00	.99	16.21	.06	.71
6804	T-Bait	0	2	.20	55.00	.05	27.50	.00	.00
6804	T-Bait	22	4	.39	150.00	.15	37.50	.00	.01
	Sub Total		6	.59	205.00	.20	34.17	.00	.01

6806	Dirt	0	183	17.94	3340.00	3.27	18.25	.59	6.95
6807	Rocks	0	88	8.63	1211.00	1.19	13.76	.10	1.21
6808	Needles	0	23	2.25	251.00	.25	10.91	.01	.07
6809	Cones	0	1	.10	2.00	.00	2.00	.00	.00
	Total Other		371	36.37	10530.00	10.32	28.38	3.75	10.47

Table 22. Percent frequency and percent volume of bear food taxon for each month and rank of each.

	March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Total		Rank	
	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.
	N=5		N=30		N=140		N=158		N=207		N=246		N=151		N=72		N=11		N=1020			
Mammals	80.0	49.0	53.3	24.7	34.3	11.3	18.4	5.8	21.7	7.1	24.8	6.9	21.2	6.8	18.1	6.6	72.7	67.7	25.1	8.7	6	5
Insect	20.0	2.0	40.0	7.0	35.7	3.7	42.4	6.3	38.2	9.0	36.6	8.5	15.2	2.5	5.6	0.6	--	--	32.0	6.0	4	6
Birds	--	--	--	--	0.7	0.1	1.3	0.7	0.5	0.5	--	--	2.7	.03	--	--	--	--	0.9	.03	9	9
Pine Nuts	20.0	6.0	3.3	0.7	2.1	0.2	0.6	.01	1.5	0.6	2.4	1.6	13.3	12.3	33.3	31.0	9.1	9.1	4.7	4.1	8	7
Sporophytes	--	--	20.0	3.8	7.1	1.9	18.4	9.1	12.6	5.0	8.1	3.4	2.7	0.2	1.4	0.3	--	--	9.4	3.7	7	8
Forbs	--	--	23.3	10.2	37.9	17.3	60.8	35.3	51.7	31.6	27.2	15.3	16.6	6.9	20.8	13.6	--	--	36.3	20.2	3	2
Graminoids	20.0	8.0	53.3	26.3	83.6	52.9	74.7	28.5	57.0	25.4	44.7	17.8	43.1	15.5	26.4	11.5	--	--	55.3	25.1	1	1
Fruit	20.0	20.0	20.0	8.0	11.4	3.5	10.1	3.2	13.1	6.2	50.0	34.7	63.6	46.9	29.2	22.5	18.2	18.2	30.2	19.7	5	3
Debris	80.0	15.0	70.0	19.1	--	--	48.1	11.8	47.3	14.6	37.0	11.7	13.9	3.0	12.5	5.0	18.2	5.0	36.8	10.4	2	4

domestic cattle were 11.37 and 4.14 representing 45.3 percent and 47.4 percent of the total frequency and volume of all mammals in the scats analyzed. Most of the domestic cattle are available from livestock boneyards along the East Front.

A large amount of debris was found in scats. Ingestion of debris appears to be related to mammal feeding, root digging, pine nut digging, and insect feeding. During these activities bears ingest large amounts of dirt, litter, and wood chips. A small amount of garbage was found in the scat contents. Many boneyards of the front include garbage and open pit garbage dumps are also available.

Evidence of bird feeding was noted in the sample of scats analyzed. The little activity noted was concentrated in the May-September period. We hypothesize that some feeding may be related to the nesting season of many birds and the possibility of opportunistic predation on ground nesting bird species. Species determination was not possible.

Plant parts selected by grizzlies varied with species. Berries and leaf parts were common items from shrub species. Graminoids were primarily composed of stem or leaf parts. The parts of forbs varied considerably by species. Upper plant parts such as leaves, stems, fruit or seed, and flowers were commonly eaten for species such as Heracleum lanatum, Angelica spp., Equisetum spp., Taraxacum spp., and Lathyrus spp. Roots, tubers and corms were parts selected for species such as Hedysarum spp., Lomatium spp., and Claytonia megarhiza.

Den Studies

Sixty-eight grizzly bear dens have been located since 1977 in and near the study area (Table 23). Fifty-six of these dens were located North of the Sun River and twelve were South of the Sun River (Figures 26 and 27). Fifty-six of these dens were east of the Continental Divide and twelve were located west of the Continental Divide. Data from those dens not visited or found on the ground are considered accurate, but may be subject to change if a ground inspection is made.

Dens were found in eleven different land types and nine different habitat types. East of the divide dens ranged in elevation between 1859-2438 m (6097-8000 ft) and averaged 2164 m (7100 ft). Slopes ranged between 35-80% averaging 58%, and the mean aspect of dens was 36°. Dens west of the divide ranged between 1768-2438 m (5799-8000 ft) averaging 2019 m (6625 ft). Slopes ranged between 30-80% with a mean of 52%, and the mean aspect was 65°.

Gillespie and Jonkel (1980) reported that dens in the south fork of the Flathead River were on southwestern to southeastern exposures. Seventy percent of East Front dens were on northwest (315°) to southeast (135°) aspects (Figure 28). To compare the mean aspect of dens west and east of the continental divide Gillespie and Jonkel's (1980) data were combined with data from the present study. The mean aspect for dens west of the divide (92°, N=19) was different (P 0.10) than the mean for dens east of the divide (36°, N=56). The mean aspect (194°, N=7) just for dens in Gillespie and Jonkel's (1980) study was also different (P 0.001) than for our study. Servheen's (1981) mean den aspect (232°, N=15) for the Mission Mountains also differed (P 0.0025) from east side dens. The mean aspect for dens from our study that were west of the divide was

Table 23. Data from 68 grizzly bear dens within the study area, 1977-86.

Den No.	Name Location	Type Den	Elevation	Aspect (°)	% Slope	Habitat Type	Land Type	No. yrs. Used	Condition	Bear No.
1[4/]	Hurricane Mtn	Dug	2073	N40E	60	ABLA/PIAL/VASC	VI	1	Good	335
2[3/]	Hoy Gulch	Dug	2012	N40E	50	ABLA/PIAL/VASC	VI	2	Good	257
3[3/]	Kid Creek	Natural Cavity	2060	N350W	40	PIAL/ABLA	VI	1	Good	220
4[3/]	Rival Creek	Dug	2196	N290W	70	Scree	VI	1	Good	220
*5[3/]	Rival Creek	Dug	2012	N47E	52	PIAL/ABLA	VI	3	Good	257
6[3/]	Bruce Creek	Dug	2012	N335W	35	ABLA/PIAL/XETE	VI	1	Caved in	Unkn.
*7[1/3/]	Mt Lockhart	Dug	2256	N20E	50	ABLA/PIAL/VASC	202	1	Unkn.	220
*8[3/]	Ear Mtn	Dug	2073	N20E	40	ABLA/PIAL/VASC	202	2	Good	273
*9[1/]	Headquarters Cr	Dug	2073	N70E	60	ABLA/PIAL/VASC	VIII	1	Unkn.	218
10[1/]	Lick Creek	Dug	2073	N20E	50	ABLA/XETE/VASC	VIII	1	Unkn.	223
*11[3/]	Rock Creek	Dug	2134	N50E	40	ABLA/XETE/VASC	VII	1	Unkn.	271
12[4/]	Slategoat Mtn	Dug	2072	N40E	40	ABLA/XETE/MEFE	Vc	1	Good	510
13[4/]	Miners Creek	Dug	2250	S120E	60	ABLA/PIAL/VASC	Va	1	Good	Unkn.
14[4/]	Miners Creek	Dug	2262	S190W	40	PIAL/ABLA	VI	1	Good	Unkn.
15[4/]	Wapiti Creek	Dug	2371	S140E	65	ABLA/XETE	VI	1	Good	Unkn.
16[4/]	Wapiti Creek	Dug	2371	S140E	65	ABLA/XETE	VI	1	Good	Unkn.
17[4/]	Wapiti Creek	Dug	2371	S140E	65	ABLA/XETE	VI	1	Good	Unkn.
18[4/]	Slategoat Mtn	Dug	2340	S110E	65	ABLA/PIAL/VASC	VI	1	Caved in	Unkn.
19[3/4/]	Ear Mtn	Dug	2140	N60E	55	Scree	-	1	Good	Unkn.
20[4/]	Wright Creek	Dug	2189	N70E	70	PIAL/ABLA	202	1	Caved in	Unkn.
21[3/]	Rocky Mtn	Dug	2250	N40E	80	ABLA/PIAL/VASC	202	1	Caved in	Unkn.
22[3/]	Rival Creek	Dug	2134	S220W	60	Scree	202	1	Caved in	Unkn.
23[4/]	Open Creek	Dug	2134	S200W	65	ABLA/PIAL/VASC	Vb	1	Good	220
24[4/]	Bennie Hill	Dug	2085	N260W	60	Scree	VI	1	Good	335
25[4/]	Miners Fork	Dug	2256	N40E	65	ABLA/PIAL/VASC	Va	1	Good	548
26[4/]	Chute Mtn	Dug	2255	N40E	40	ABLA/	18	1	Caved in	273
27[4/]	Wright Creek	Dug	2170	N60E	50	Scree	202	1	Good	544

Table 23. Data from 68 grizzly bear dens within the study area, 1977-86, (continued).

Den No.	Name Location	Type Den	Elevation	Aspect (°)	% Slope	Habitat Type	Land Type	No. yrs. Used	Condition	Bear No.
28[4/]	Emerald Lake	Natural Cavity	2134	S200W	60	ABLA/PIAL/VASC	202	1	Good	333
29[4/]	Washout Creek	Dug	2048	E90E	80	ABLA/PIAL/VASC	VI	1	Good	257
30[4/]	Route Creek	Natural Cavity	2170	N20E	15	ABLA/PIAL/VASC	II	1	Good	518
31[1/5/]	Clack Creek	Natural Cavity	2390	S120E	50	Scree	VI	1	Good	230
32[4/]	Waldron Creek	Dug	2183	W270W	65	ABLA/	18	1	Unkn.	220
33[4/]	Bear Gulch	Dug	2256	S265W	60	PIAL/ABLA	18	1	Good	273
34[4/]	Chute Mtn.	Dug	2146	S100E	60	ABLA/PIAL/VASC	-	1	Good	273
35[4/]	Rierdon Gulch	Dug	2256	N20E	60	ABLA/PIAL/VASC	202	2	Good	500
36[1/5/]	Bloody Hill	Dug	2317	S120E	55	ABLA/PIAL/VASC	VI	1	Good	335
37[1/5/]	Clack Creek	Unknown	1902	N15E	50	Unknown	VI	1	Unkn.	498
38[1/3/]	Patrol Ridge	Unknown	1860	N315W	80	Unknown	VI	1	Unkn.	485
39[1/5/]	Waldron Cr	Dug	2222	S230W	40	ABLA/PIAL/VASC	181	1	Good	220
40[1/5/]	Twenty-five Mile Cr.	Dug	1555	N30E	50	Unknown	-	1	Unkn.	485
41[1/5/]	Twenty-five Mile Cr.	Dug	1768	S100E	50	ABLA/MEFE	-	1	Unkn.	313
42[1/]	Benson Cr.	Dug	1859	N335W	50	ABLA/MEFE	181	1	Occupied	366
43[1/]	Benson Cr.	Dug	2195	S110E	50	ABLA/PIAL/VASC	181	1	Fresh	Unkn.
44[1/]	Mt. Frazier	Unknown	2012	N320W	60	Scree	VI	1	Unkn.	317
45[1/3/]	Waldron Cr.	Dug	2073	N15E	60	ABLA/PIAL/VASC	202	1	Good	392
46[1/]	Route Creek	Dug	2377	S110E	75	PIAL/ABLA	VI	0	Fresh	220
*47[1/]	Crow Pk.	Dug	2438	S220W	40	PIAL/ABLA	-	1	Good	229
48[2/]	Burned Pt.	Dug	2317	N30E	60	ABLA/PIAL/VASC	182	1	Unkn.	347
*49[3/]	Camp Cr.	Dug	2189	N6E	65	ABLA/LUHI/MEFE	183	1	Good	Unkn.
*50[1/5/]	Evans Pk.	Dug	2164	N24E	65	ABLA/PIAL/VASC	-	1	Good	282
51[1/]	Goat Cr.	Dug	2024	N45E	40	ABLA	VIII	1	Unkn.	355
52[1/]	Straight Cr.	Dug	2170	S140E	70	PIAL/ABLA	VI	1	Unkn.	328
53[6/1/3/]	S. Fk. Waldron	Dug	2207	N315W	60	ABLA/PIAL/VASC	181	1	Caved In	392 and 312

Table 23. Data from 68 grizzly bear dens within the study area, 1977-86, (continued).

Den No.	Name Location	Type Den	Elevation	Aspect (°)	% Slope	Habitat Type	Land Type	No. yrs. Used	Condition	Bear No.
54[1/]	Mt. Frazier	Unknown	2115	N75E	80	Scree	202	1	Unkn.	317
55[1/]	Bear Gulch	Dug	2225	N20E	70	ABLA/PIAL/VASC	202	1	Unkn.	500
56[1/]	Benson Crk	Dug	1920	N340W	75	ABLA/MEFE	181	1	Unkn.	366
57[1/]	Steamboat Mtn.	Dug	2280	N335W	80	Scree	183	1	Unkn.	335
58[1/5/7/]	W. Fk. Falls Ck	Dug	2225	N330W	70	PIAL/ABLA	183	1	Unkn.	316
59[1/5/7/]	Twenty-five Mile Creek	Dug	1951	S135E	65	ABLA/XETE/VAGL	-	1	Unkn.	313
60[1/5/7/]	Dry Fk. Blackfoot River	Dug	1930	N360N	30	ABLA/	-	1	Occupied	301
61	Rierdon Gulch	Dug	7560	10	50	Scree	-	1	Occupied	500
62	Md.Fk.Birch Cr.	Dug	7520	350	45	PIAL/ABLA	-	1	Occupied	467
63	Challenge Cr.	Dug	7530	220	45	ABLA/	-	1	Occupied	366
64	Baking PowderCr.	Dug	6880	70	40	ABLA/PIAL/XETE	-	1	Occupied	316
65	Twenty-Five Mile Cr.	Dug	6400	135	65	ABLA/XETE/VAGL	-	1	Occupied	313
66	Cooney Cr.	Dug	8000	70	30	ABLA/PIAL/VASC	-	1	Occupied	301
67	Goat Mtn.	Natural Cavity	7000	310	80	Scree	202	1	Occupied	466
68	Grizzly Basin	Dug	8000	50	80	ABLA/	VIII	1	Old	Unkn.

* Reported in Schallenberger and Jonkel 1980.
1 - Located by airplane radio location.
2 - Den area visited but den not located.
3 - Ground inspection of den made.
4 - Photographed and observed by helicopter.
5 - Den location west of divide.
6 - Bears 392 and 312 appear to be in the same den.
7 - Den locations not plotted in figures 25 and 26.

8072/2

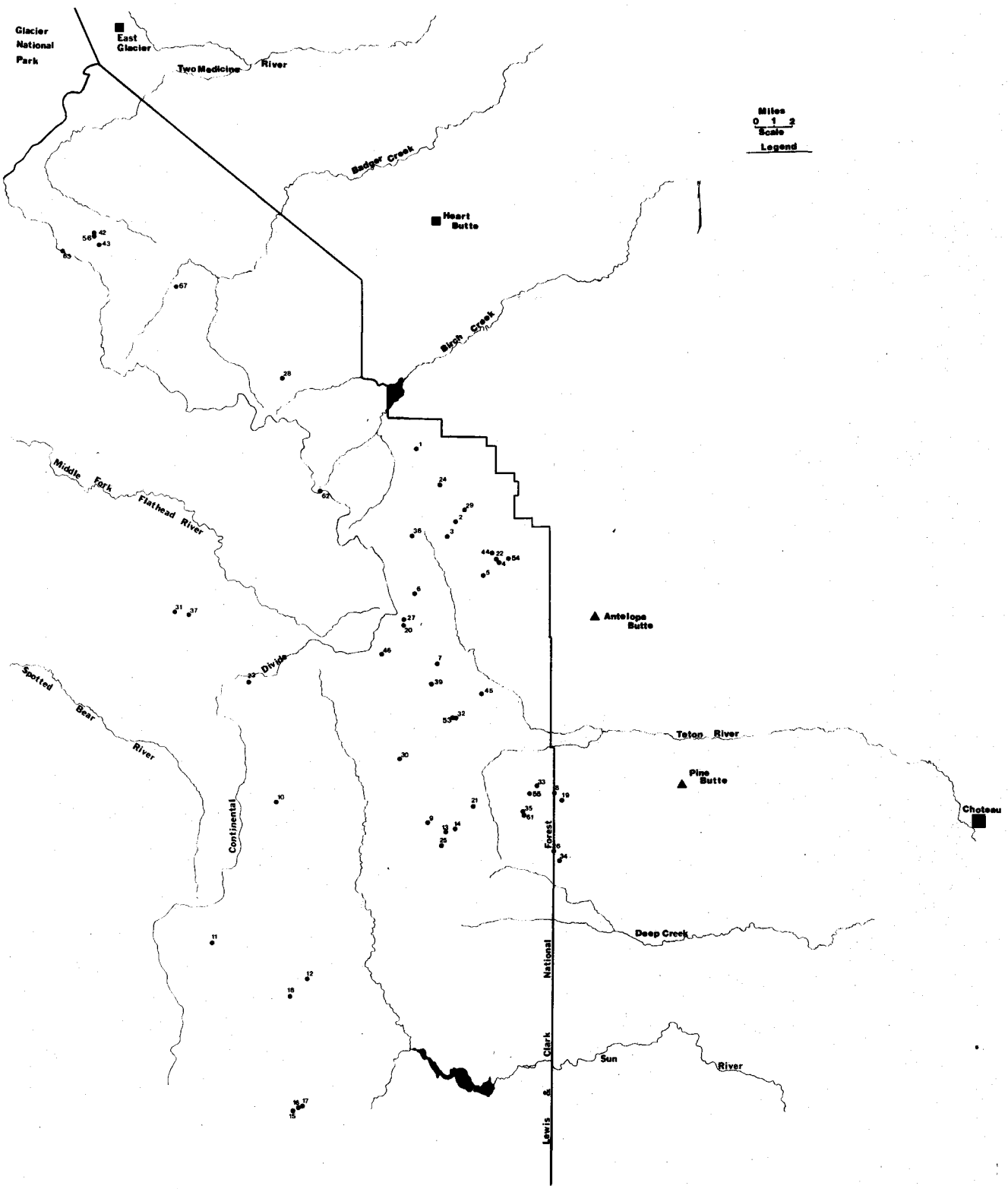

Figure 26. Den sites north of the Sun River, 1977-86.

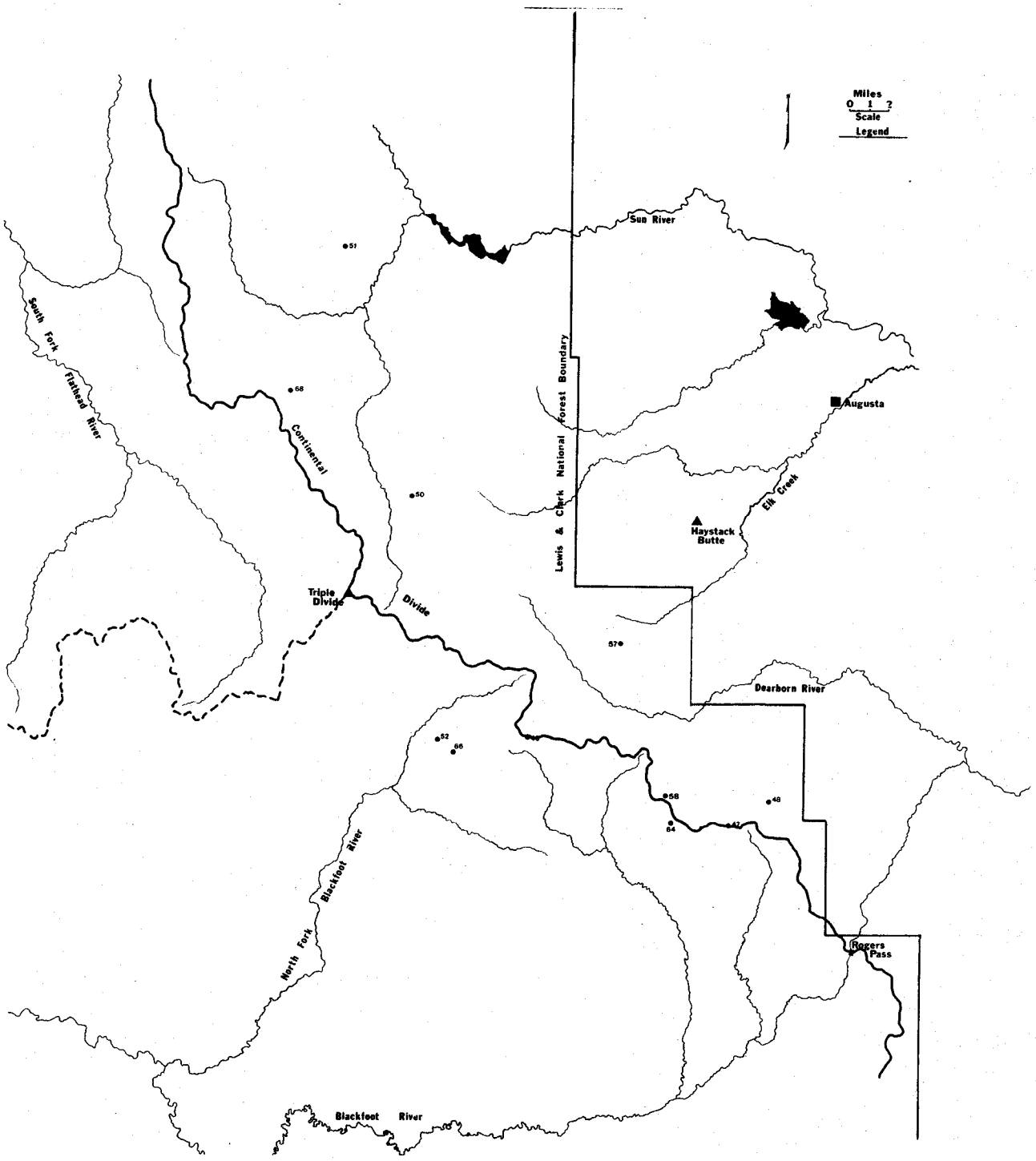

Figure 27. Den sites south of the Sun River, 1977-86.

not significantly different (65°, N-12, P=0.25) from the mean east of the divide. These findings show that grizzlies east of the divide use northeast aspects while grizzlies west of the divide use southwest aspects for denning. Because northern aspects retain more snow depth than southern aspects and snowfall east of the divide is less than that west of the divide, the above findings would be expected.

Gillespie and Jonkel's (1980) data on den elevation were also combined with our data to compare den elevation on each side of the divide. Westside dens were lower ($\bar{x}$=1977m, P=0.0005) than eastside dens ($\bar{x}$=2164 m). Den elevation in the Mission Mountains ($\bar{x}$=2124 m) did not differ (P=0.10) from that east of the divide.

All dens in the present study were dug except four which were natural cave dens. Three of these were found in one area. Two of these four dens were known to have been used by grizzlies. Three dens in our sample were used more than one year by the same grizzly bear. Seven dens were in an unusable condition the year following their original occupation.

For all grizzlies den entrance dates ranged between October 14 and December 5 with a median date of November 8 (Table 24). Movement to dens occurred from October 6 to approximately December 1. Emergence dates ranged between March 10 and May 13 with a median date of April 10 (Table 25). Bears in the Mission Mountains moved to dens between October 10 and November 20 and denned between November 2 and November 22 (Servheen (1981)). Den emergence occurred between April 12 and May 9 and den entrance between November 2 and November 26 in the South Fork of the Flathead River (Gillespie and Jonkel (1980)).

Adult males and females with yearlings or two year-olds emerged from their dens (median = March 30) earlier than females with cubs (median = May 1) and subadults (median = April 13). Pregnant females entered their dens (median = November 5) earlier than subadults (median = November 8) and adult males and females with cubs which entered on the same median date (November 18).

Impacts of Oil and Gas Activity

No oil and gas wells were drilled in 1986 and no seismic exploration was conducted. As a result no work was accomplished in this area. The reader is referred to past annual reports for data and study results regarding this topic.

HABITAT STUDIES

Bear Management Unit Constituent Elements

East Front grizzly bear habitat was divided into 6 Biological Evaluation Units in 1984 (USDA). These units were modified in 1985 and constituent element maps were created for two evaluation units (Figures 29 and 30). These units were renamed Bear Management Units (BMUs) for better interagency communication (Young, 1986). Constituent element maps for the remaining 4 BMUs were created in 1986 (Figures 31-34).

Constituent elements were defined as spring, denning, summer, and fall habitats according to the U.S.F.S. (USDA 1984). Summer and fall habitats encompass the

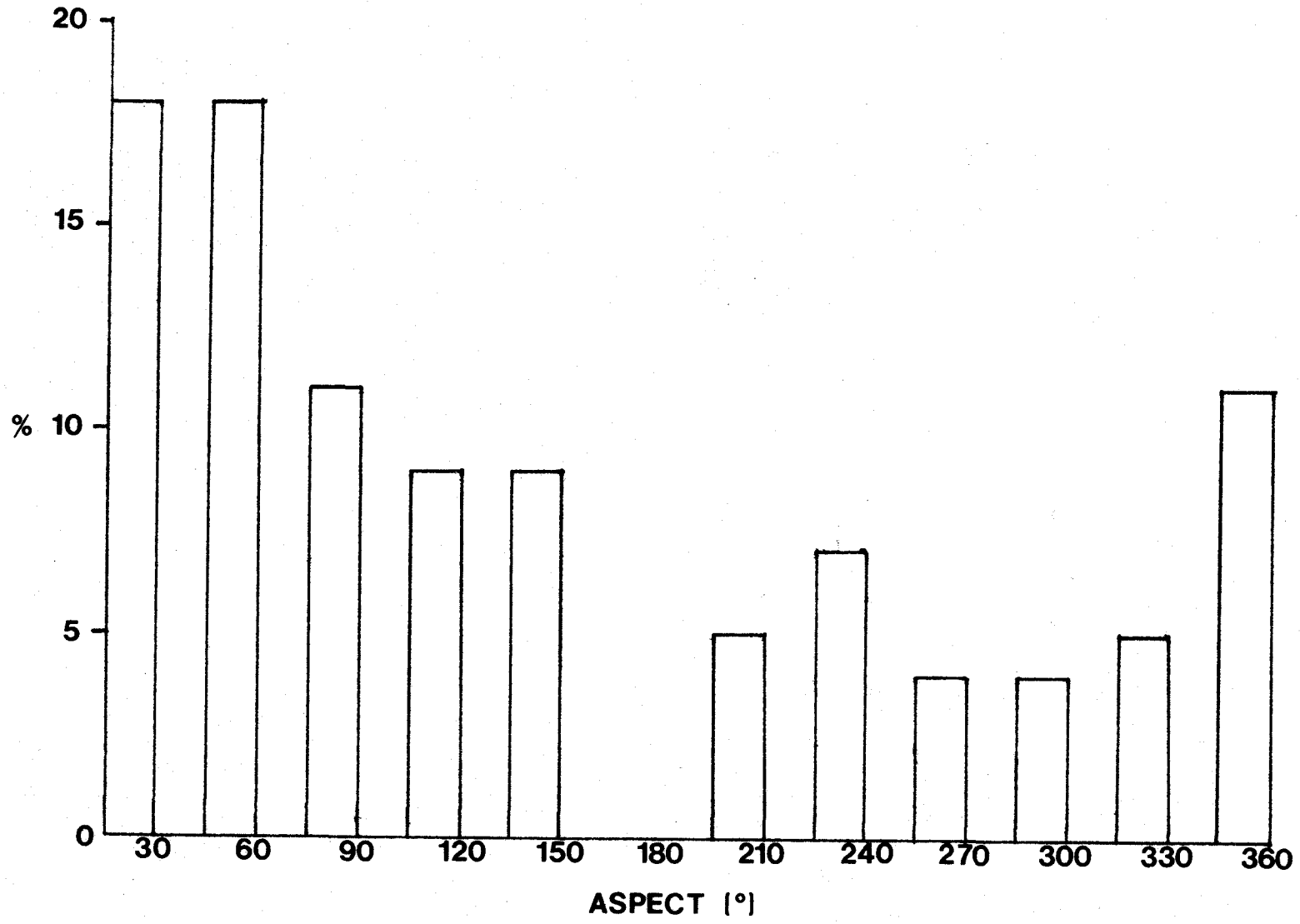

Figure 28. Percent of grizzly dens in each 30 degree aspect category, 1977-86

Table 24. Dates of movements to dens and final entry of dens for grizzlies, 1980-86.

Bear No.	Sex	Age	Year	Movement to Den Site	Approximate Den Entry	Reproductive Status
257	F	10.5	1980	October 18	November 5	Cubs present
220	F	19.5	1980	October 20	November 5	Cubs present
223	M	6.5	1980	After October 6	November 23	--
257	F	11.5	1981	October 13	November 2	Pregnant
220	F	20.5	1981	October 22	November 2	Pregnant
335	F	3.5	1981	After October 28	November 2	No cubs
273	F	7.5	1981	October 28	November 2	No cubs
333	M	3.5	1981	November 8	Unknown	--
220	F	21.5	1982	November 4	November 9-18	Cubs present
257	F	12.5	1982	November 4	November 9-18	Cubs present
273	F	8.5	1982	October 25	November 22	Pregnant
335	F	4.5	1982	November 2	November 4	Bred and possibly pregnant
544	M	2.5	1982	November 4-7	November 8	--
548	F	10.5	1982	November 18-21	November 22-25	Cubs present
257	F	13.5	1983	October 6	October 21-November 5	Pregnant
335	F	5.5	1983	October 12	November 5-9	Pregnant
518	F	2.5	1983	October 12	November 27-30	--
220	F	22.5	1983	October 28-November 1	November 5-9	Pregnant
500	F	4.5	1983	October 28-November 1	November 5-9	Pregnant
273	F	9.5	1983	November 1-5	November 5-9	Cubs present
485	M	7.5	1983	October 28	November 5-9	--
498	M	4.5	1983	November 15-30	December 5	--
220	F	23.5	1984	October 22	November 5	Cubs present
500	F	5.5	1984	October 29-November 5	November 5	Cubs present
485	M	8.5	1984	November 8	November 15-26	--
328	M	2.5	1984	November 8-15	November 15-26	--
313	F	3.5	1984	October 8	October 22-November 8	No cubs
366	F	5.5	1984	October 22-November 15	November 8-15	Bred and possibly pregnant
355	M	8.5	1984	November 15	November 15-26	--
317	F	2.5	1984	October 22-November 5	November 5	No cubs
392	M	2.5	1984	November 8-15	November 15-26	--
498	M	5.5	1984	November 15	November 27-December 1	--
392	M	3.5	1985	October 21-29	October 29-November 12	--
312	F	2.5	1985	October 21-29	October 29-November 12	No cubs
500	F	6.5	1985	October 18-21	October 29-November 12	Yearling cubs present

Table 24. Dates of movements to dens and final entry of dens for grizzlies, 1980-86.

Bear No.	Sex	Age	Year	Movement to Den Site	Approximate Den Entry	Reproductive Status
317	F	3.5	1985	October 21-29	October 29-November 12	No cubs
366	F	6.5	1985	October 4-29	October 29-November 12	Pregnant
335	F	7.5	1985	October 29-November 12	November 12	No cubs
316	F	3.5	1985	October 29-November 12	November 12	No cubs
301	F	13.5	1986	October 6-14	October 6-14	Bred and possibly pregnant
313	F	5.5	1986	October 24-November 10	October 24-November 10	Unknown
316	F	4.5	1986	October 6-14	October 6-14	Bred and possibly pregnant
366	F	7.5	1986	October 29-November 10	October 29-November 10	Bred and possibly pregnant
466	F	15.5	1986	November 10-December 1	November 10-December 1	Cub present
467	M	3.5	1986	October 29-November 10	October 29-November 10	--
500	F	7.5	1986	October 17	After October 17	Unknown

8072/2

Table 25. Dates of den emergence and movement from den sites, 1980-86.

Bear No.	Sex	Age	Year	Approximate Den Emergence	Movement from Den Site	Reproductive Status
220	F	19.5	1980	April 29-May 13	May 13	Cubs present
257	F	11.5	1981	March 10-March 28	March 28	Yrling cubs present
220	F	20.5	1981	April 18	April 24	Yrling cubs present
223	M	7.5	1981	March 28	March 28-April 15	--
220	F	21.5	1982	May 1	May 15	Cubs present
257	F	12.5	1982	April 27-30	May 1	Cubs present
333	M	4.5	1982	April 23-26	April 27	--
273	F	8.5	1982	March 20-30	April 1-4	No cubs
335	F	4.5	1982	April 5-18	April 19	No cubs
220	F	21.5	1983	April 6	April 13	Yrling cubs present
257	F	13.5	1983	March 11	March 26	Yrling cubs present
548	F	11.5	1983	April 6	April 13	Yrling cubs present
273	F	9.5	1983	April 5	April 18	Cubs present
335	F	5.5	1983	April 13	April 21	No cubs
544	M	3.5	1983	April 13	April 18	--
220	F	23.5	1984	May 1-8	May 15-25	Cubs present
500	F	5.5	1984	April 30-May 7	May 8	Cubs present
273	F	10.5	1984	March 31	April 1-4	Yrling cubs present
335	F	6.5	1984	April 4	April 9-14	Cubs present
485	M	8.5	1984	April 4-10	April 10-14	--
498	M	5.5	1984	March 23	April 1-4	--
518	F	3.5	1984	March 31	April 1-9	No cubs
500	F	6.5	1985	Before April 7*	April 7-8	Yearling cubs present
485	M	9.5	1985	April 8-14	April 14-15	--
328	M	3.5	1985	Before April 7*	April 1-8	--
313	F	3.5	1985	May 2-7	May 7-13	No cubs
366	F	6.5	1985	April 8-15	April 29-May 2	No cubs
355	M	9.5	1985	Before April 7*	April 7-8	--
317	F	3.5	1985	Before April 7*	April 7-8	No cubs
392	M	3.5	1985	Before April 7*	April 7-8	--
301	F	13.5	1986	April 1-15	April 1-15	2 year olds present
313	F	5.5	1986	April 1-7	April 1-7	No cubs
316	F	4.5	1986	March 20-April 1	March 20-April 1	No cubs

Table 25. Dates of den emergence and movement from den sites, 1980-86 (continued).

Bear No.	Sex	Age	Year	Approximate Den Emergence	Movement from Den Site	Reproductive Status
335	F	8.5	1986	April 15-May 1	April 15	No cubs
355	M	9.5	1986	March 15	March 15	--
366	F	7.5	1986	April 15-May 1	April 15-May	No cubs (litter lost)
500	F	7.5	1986	March 20-April 1	March 20-April 1	2 year olds present

*No flights were made before April 8 due to budget constraints in 1985.

8072/2

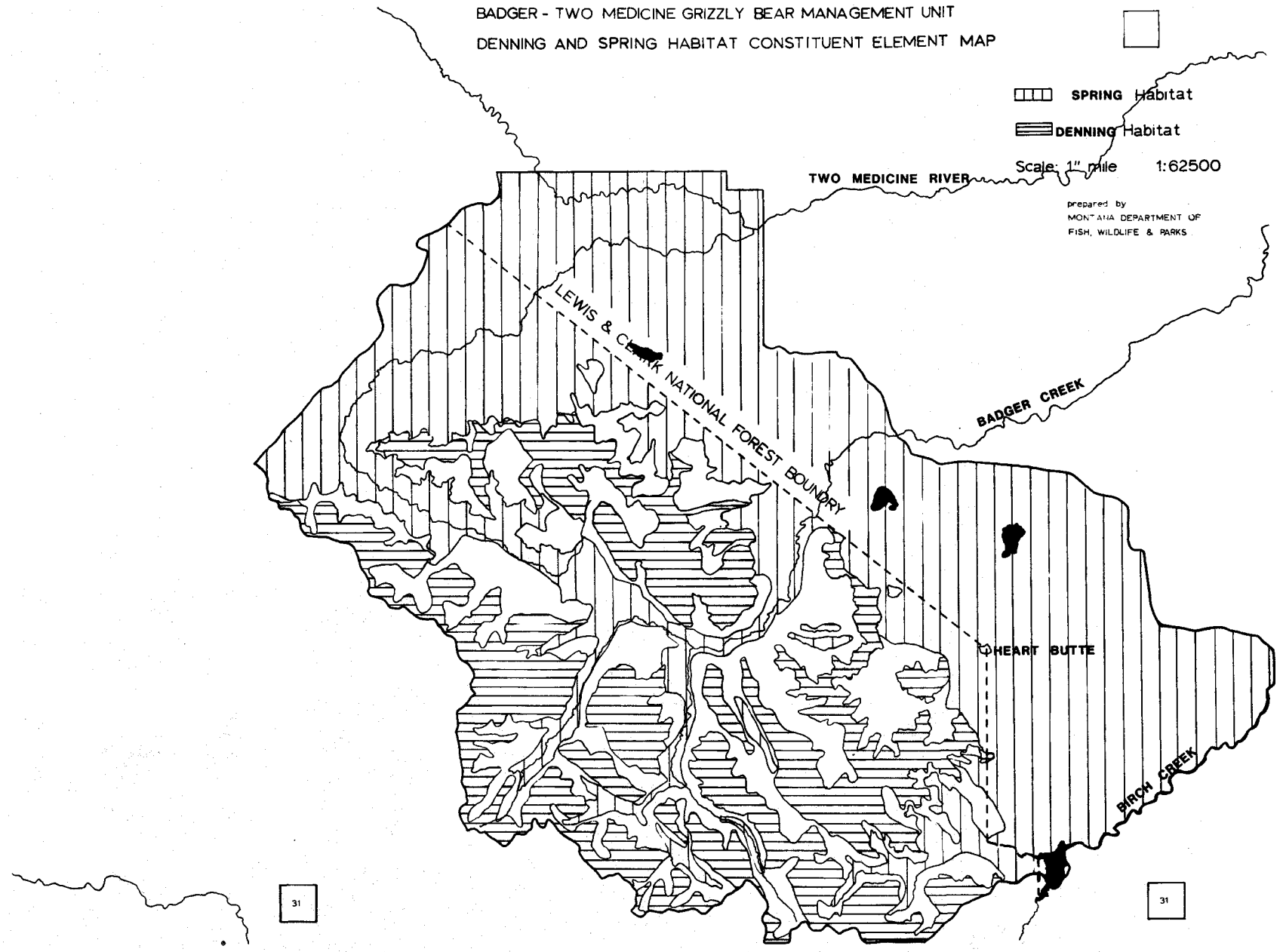

Figure 29. Constituent element map, 1986.

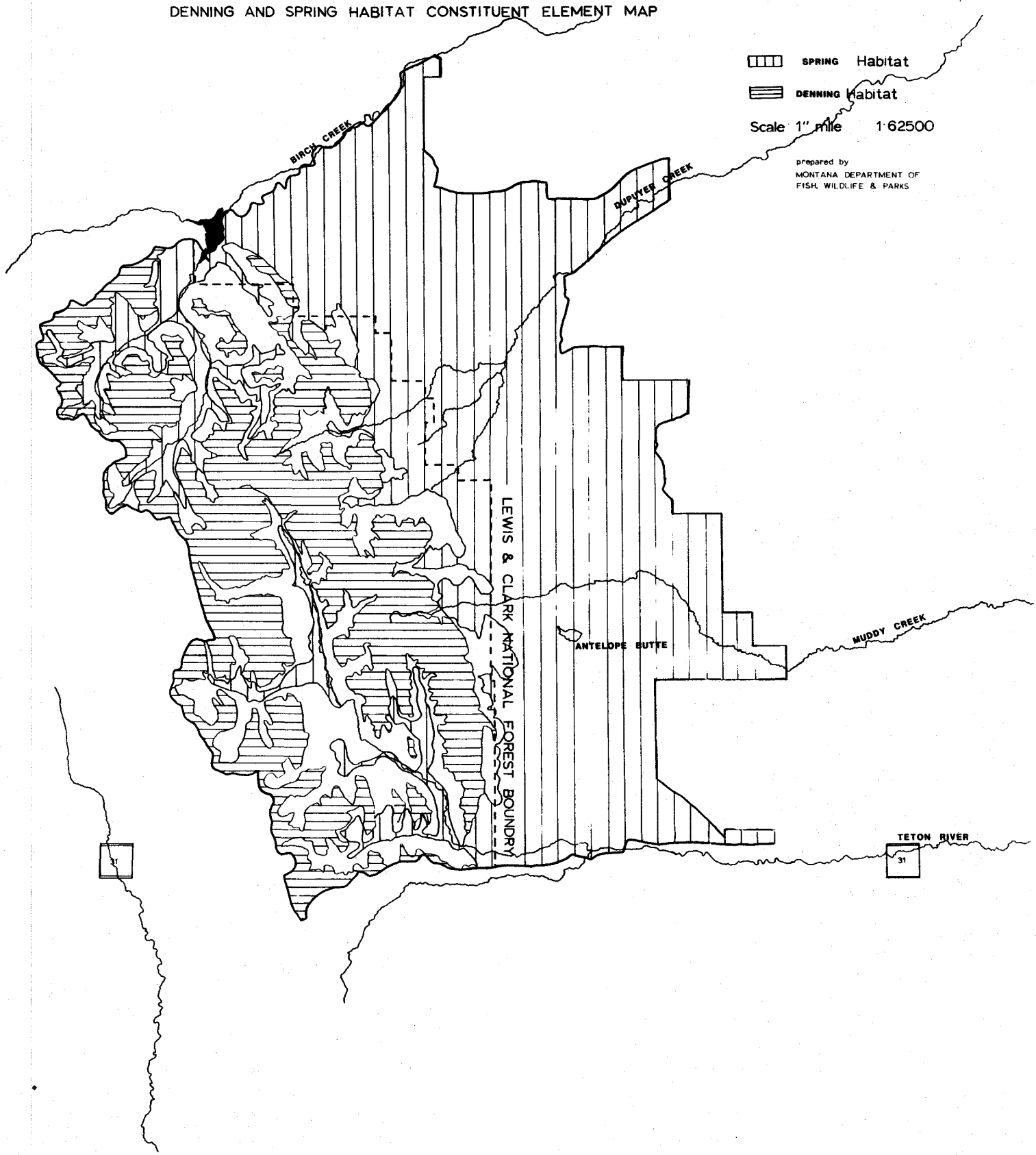

Figure 30. Constituent element map, 1986.

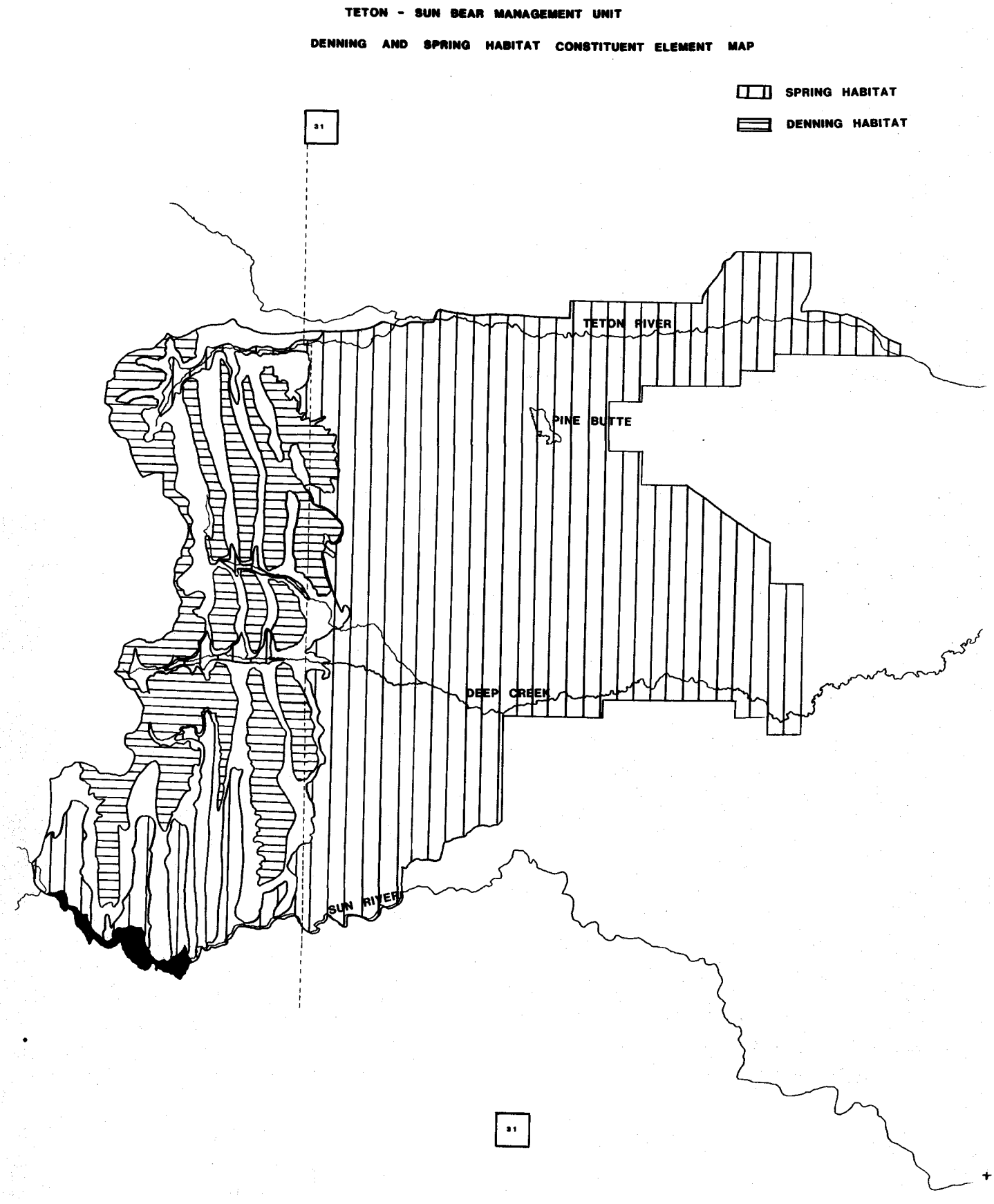

Figure 31. Constituent element map, 1986.

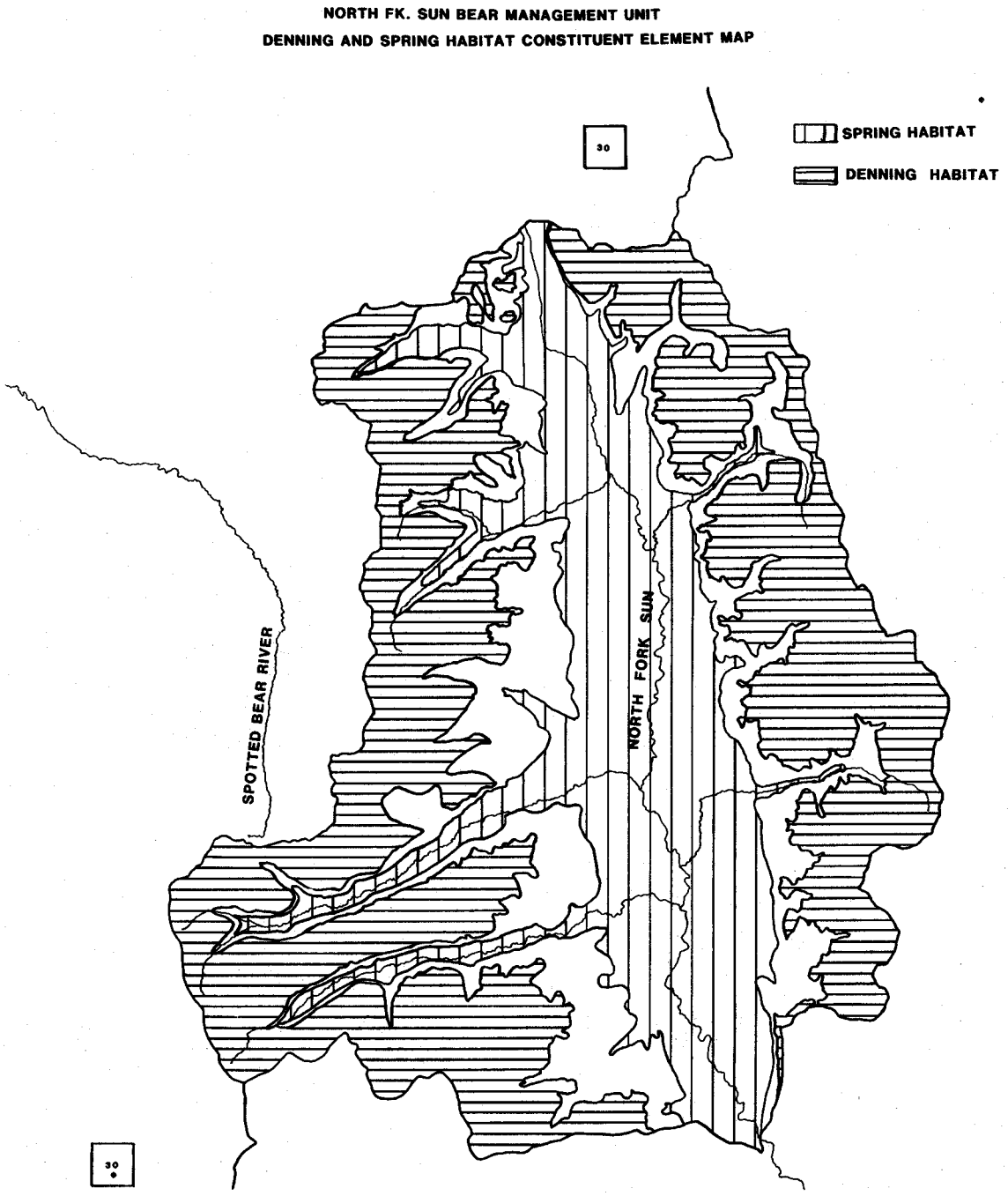

Figure 32. Constituent element map, 1986.

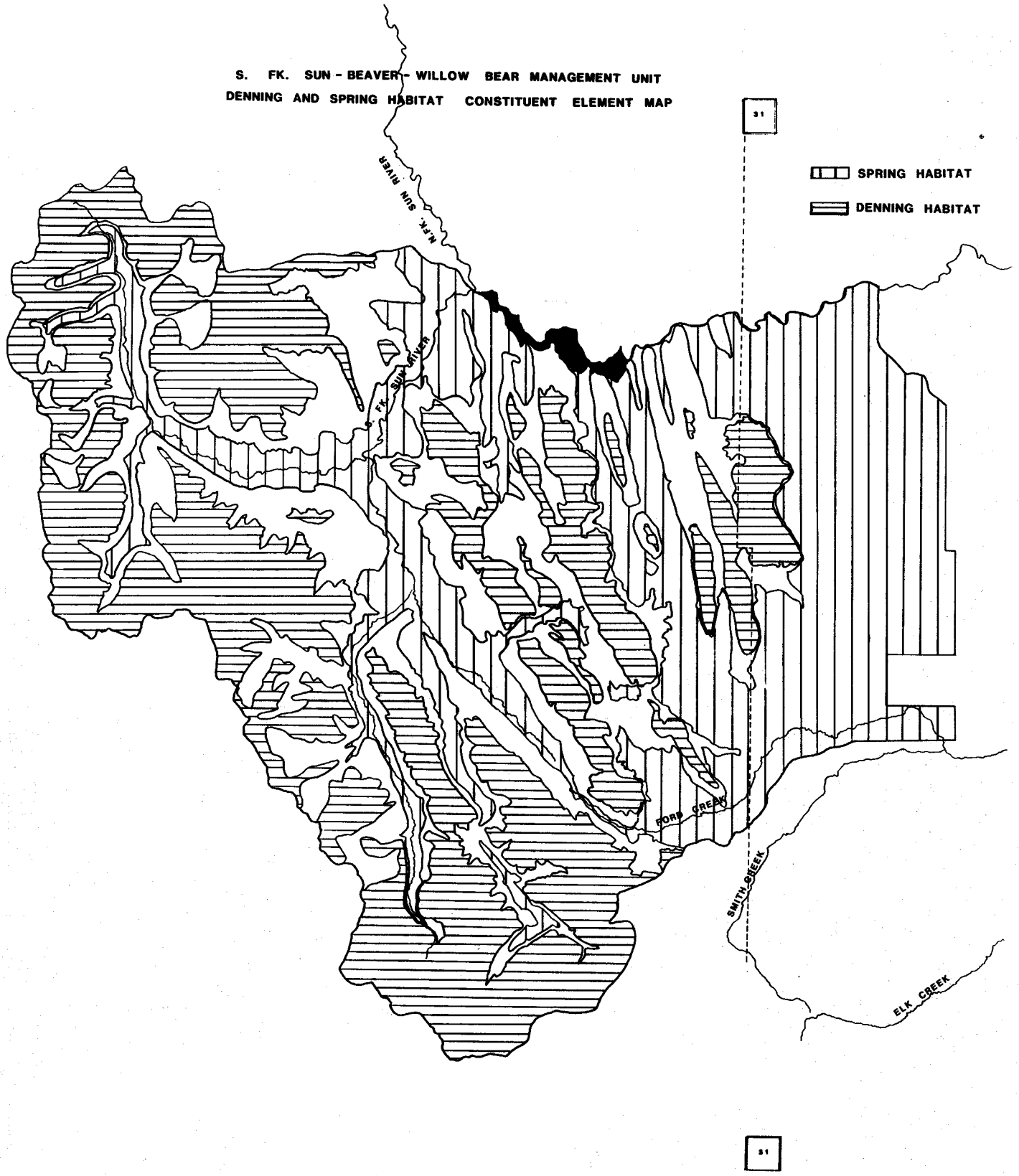

Figure 33. Constituent element map, 1986.

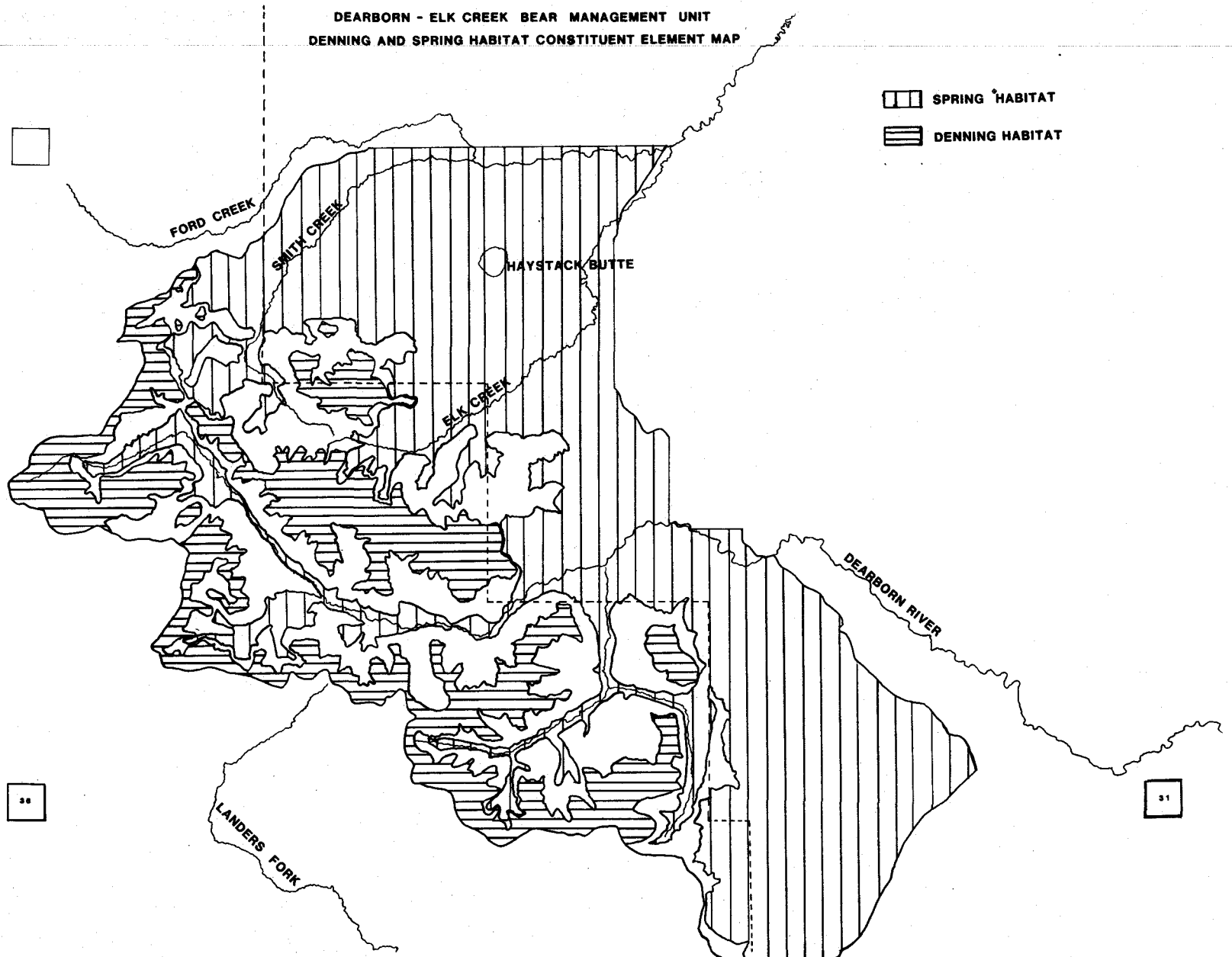

Figure 34. Constituent element map, 1986.

entire BMU in each unit. Therefore constituent elements maps only provide specific information on spring and denning habits which are provided by portions of each BMU.

A total of 1756 km^2 (677.8 mi^2) of bear habitat were constituent element mapped in 1985. Four BMUs covering 2994 km^2 (1155.7 mi^2) were constituent element mapped in 1986. Almost all (99.4%) of the denning habitat occurs within the Lewis and Clark Forest (Table 26). In contrast over 60% of the spring habitat of grizzly bears is outside of the Lewis and Clark Forest. In only two BMUs does the proportion of spring habitat within the forest exceed the proportion outside the National Forest. The four other BMU's have 63.9 to 81.5 percent of the spring range outside of the National Forest.

This emphasizes the important relationship between public and private lands along the Front. This marriage of public and private lands to form a complete ecological land unit suitable for grizzly bears is more significant in some BMUs where a predominance of spring habitat is outside of the National Forest. For example the Teton-Birch Creek BMU has over 80 percent of its spring habitat outside of the National Forest. Distribution data of grizzly bears within this unit indicates the high value of these lands to bears within this BMU (Figure 4).

Vegetation Studies

A total of 300 activity site plots have been recorded at radio locations between 1978 and 1986. These include 237 feed sites and 97 bed sites. activity site plots were recorded for 27 different grizzly bears during the study.

The frequency of activity plots by bear number, habitat type, habitat component, elevation, aspect, slope and date were evaluated to determine bias in sampling. Future emphasis in activity plot recording can be directed to weaknesses in our sampling. Up to this date activity plots have been conducted in 42 forested habitat types (Pfister et al, 1977), two grassland habitat types (Mugeggler and Handl, 1974), and 11 community types (Aune et al (1984)). Activity plots were recorded within 13 different habitat components. Generally habitat components most frequently used by grizzly bears received emphasis in activity plot data (Table 27). Bears were engaged in 11 feeding and 3 nonfeeding activities at sites where an activity plot was conducted (Table 28). Again the more uncommon activities received less emphasis in recording activity site data. Activity plots were conducted from about 1280 meters (4200 ft) to 2866 meters (9400 ft) (Table 29).

To facilitate computer analysis of data from activity plots, a complete plant species list for the East Front was developed (Appendix B). Expansion and development of the list was continued in 1986.

At the present time 10 species representing 6 genera of trees, 75 species from 36 genera of shrubs; 10 species within 7 genera of ferns or fern allies; 137 species representing 41 genera of graminoids; and, 486 species from 215 genera of forbs have been reported and listed as occurring on the East Front. A total of 718 species of plants representing 304 genera is listed in Appendix B.

Table 26. Area's of Bear Managmenet Units and Spring and Denning Habitat for each unit.

Bear Management Unit	Total Area (km^2)	Denning Habitat (km^2)			Spring Habitat (km2)		
		Lewis & Clark Forest	Non Forest	Total	Lewis & Clark Forest	Non Forest	Total
Badger-Two Med.	885.8	159.0 (99.8)[1/]	0.3 (0.2)[1/]	159.3 (18.0)[2/]	181.8 (36.1)[3/]	321.8 (63.9)[3/]	503.6 (56.9)[2/]
Teton-Birch Cr.	870.2	210.2 (99.4)	1.3 (0.6)	211.5 (24.3)	94.5 (18.5)	417.6 (81.5)	512.1 (58.8
N. Fk. Sun River	650.1	308.0 (100.0)	0.0 (0.0)	308.0 (47.4)	204.5 (100.0)	0.0 (0.0)	204.5 (31.5)
Teton-Sun River	792.5	116.9 (92.2)	9.9 (7.8)	126.8 (16.0)	52.5 (20.0)	209.7 (79.9)	262.2 (33.1)
S. Fk. Sun River	808.1	415.7 (96.8)	13.9 (3.2)	429.6 (53.2)	224.4 (56.6)	171.9 (43.4)	396.3 (49.0)
Dearborn-Elk Cr.	743.3	131.5 (95.9)	5.6 (4.1)	137.1 (18.4)	91.6 (21.5)	333.9 (78.5)	425.5 (57.2)
Total	4750.0	1341.3 (9.4)	31.0 (0.6)	1372.3 (28.9)	849.3 (36.9)	1454.9 (63.1)	2304.2 (48.5)

1/ Percent of Total Denning Habitat within BMU
2/ Percent of Total BMU Area
3/ Percent of Total Spring Range within BMU

Table 27. The number and percent of feed sites and bedsites in each grizzly bear habitat component, 1978-86.

Habitat Component	Feed Site		Bed Site	
	No. Sites	Percent	No. Sites	Percent
Meadows	5	2.1	-	-
Sidehill Parks	8	3.4	-	-
Snowchutes	2	0.9	-	-
Shrubfields	9	3.9	-	-
Rock/Talus/Scree	21	9.0	-	-
Closed Timber	44	18.8	22	23.0
Open Timber	42	18.0	20	20.8
Limber Pine Savanna	10	4.2	3	3.1
Prairie Grassland	3	1.3	-	-
Mountain Grassland	1	0.4	-	-
Populus Stand	45	19.2	22	22.9
Riparian Shrub	37	15.8	29	30.2
Riparian Complex	7	3.0	-	-
Missing Records	3		1	
	237		97	

Table 28. The number and percent of activity plots for each feeding and nonfeeding grizzly bear activity type, 1978-86.

Activity	No. Sites	Percent
Feeding Activities		
Gen. Feeding	5	1.7
Carass or Carrion	12	4.0
Grazing	56	18.9
Digging Roots	34	11.4
Digging Pine Nuts	26	8.7
Digging Small Mammals	1	0.3
Tearing Logs	22	7.4
Tearing Anthills	12	4.0
Turning Rock and Cowchips	9	3.0
Feeding on Berries	42	14.1
Stripping Bark	1	0.3
Non Feeding Activities		
Bedded	58	19.5
Traveling	10	3.4
Denning-Predenning	1	0.3
Unknown	8	2.7
Missing Records	3	
	300	

Table 29. Elevations of activity plot records, 1978-86

Elevation	No. Sites	Percent
4000-4500	26	8.7
4500-5000	55	18.3
5000-5500	49	16.3
5500-6000	47	15.7
6000-6500	38	12.7
6500-7000	36	12.0
7000-7500	31	10.3
7500-8000	8	2.7
8000-8500	7	2.3
8500-9000	2	0.7
9000-9500	1	0.3
	300	

Population Biology

A decline in field emphasis from the Deep Creek to Birch Creek core study area occurred in 1984. However, marked plus observed data from grizzly bears was collected and produced a seventh year of population data from the core area. Lower intensity of field effort probably reduced the reliability of data in 1984, 1985 and 1986 as compared to previous years. Some assumptions were made regarding previously marked bears on the area.

Sex and Age Data

Table 30 presents age and sex data from the marked population within the core study area (Deep Creek to Birch Creek) during 1986. Since 1977, 35 individual grizzly bears have been ear tagged in this area (Appendix C). Twenty-eight of these have been radio monitored, 3 were moved off the study area, and 13 are known to be dead or removed permanently from the ecosystem over a ten year period.

Table 30. Age and sex data from the marked grizzly bear population, Deep Creek to Birch Creek, 1986.

	Adult	Subadult	Yearling	Cubs	Total
Male	1[1/]	2	0	0	3
Female	3[2/]	3	0	0	6
Unknown	0	0	0	0	0
Total	4	5	0	0	9

[1/] No evidence could be found in 1986 to indicate presence of marked bears 218 or 203.

[2/] Excludes Bear 548, 220, or 257 since we could not verify these bears presence in 1986.

Table 31 presents age and sex data from the marked plus observed grizzly population from Deep Creek to Birch Creek, 1986. It is likely that more bears exist than were observed on this core area in 1986. Little field effort was focused in this unit and more subadults were present but could not be clearly separated by color marking or other physical features. Several adult bears expected to be present in the area were not accounted for because little trapping has been conducted in this area since 1983.

Table 31. Age and sex data from marked plus observed grizzly bear population, 1986, Deep Creek to Birch Creek.

	Adult	Subadult	Yearlings	Cubs	Total
Male	1[1/]	2	0	0	3
Female	6	3	0	0	9
Unknown	1	2[2/]	5	6[3/]	14
Total	8	7	5	6	26

1/ Lower field effort reduced efficiency of observing adults. In 1984 we observed two different adult males and eight adult females. It is likely that 1984, 1985, and 1986 figures are lower than expected because we spent less time on this area.

2/ More subadults probably existed than could be easily distinguished in 1986. We count only those clearly identifiable to avoid duplication.

The average number of bears observed in the last seven years is 28.6 (Table 32). The average number of adults in the area has been 9 and appears to be stable.

Table 32. Age structure reported for Deep Creek to Birch Creek core area, 1980-86.

	Adult	Subadult	Yearlings	Cubs	Total
1980	8	6	6	7	27
1981	9	8	7	2	26
1982*	9	11	2	11	33
1983*[1/]	11	4	8	3	26
1984*	11	7	3	12	33
1985*	7[2/]	7	15	0[2/]	29
1986	8	7	5	6	26

* Decreased field emphasis in the core area reduced reliability at upper end of population range. It is likely more bears exist than indicated in this table. These numbers represent a minimum count of distinguishable bears based on marked and observed animals.

1/ These data were modified from that reported in Aune (1985) to reflect the discovery in 1985 of three young for bear 335 in 1984.

2/ In 1986 records indicate two females with 5 yearling cubs on Rocky Mountain apparently not observed in 1985 (one with non functioning radio collar). If adjusted there could be 9 females and 5 cubs and a total count of 36 bears present for 1985.

Density Estimation

Density estimates were calculated for 1980-86 in the Deep Creek-Birch Creek area. A major problem encountered in density estimation is determining the area used for the population estimate. Servheen (1981), and Aune and Stivers (1985), used composite home ranges for determining the area of analysis. In re-evaluating densities of bears on the East Front in 1985 we examined influences of subadults on outside polygons and the effects of habitat on polygon shape and density estimates. Three different polygons were developed using composite data from all bears captured and monitored from the area 1977-85 (Figure 35). The largest polygon (Area 3) is a simple convex polygon from all radio monitored bears. The second polygon (Area 2) is the outside polygon for all adult bears in this unit. The third polygon (Area 3) is a modified polygon with 98% of the radio locations of adult bears included and exclusion of nonhabitat areas along the mountain front which would otherwise be included in the analysis area.

Table 33 presents results of density estimates using each of 3 analysis areas and evaluating densities for developing a minimum marked population and marked plus observed population estimate. Results indicate that analysis area 3 is probably too large an area for population analysis and is not a closed area because subadult bears widely disperse into surrounding areas. Area 2 in this analysis may be a better estimate of the proper analysis area but includes significant prairie and farmland area not utilized by grizzlies along the East Front. Area 3 probably more properly estimates the actual area used by bears monitored and observed in the analysis area.

Data from the three analysis areas also indicated the extent of emmigration from the core area to areas outside. Of all the bears captured outside the core area (in the areas to the south and north of it) none have immigrated to the core area. Given the highly observed emigration and limited evidence of imigration by radio monitored bears, the consistent observation of unmarked bears in the core area, and the evidence that all bears in the area are not marked, it is unlikely that the population is at the minimum estimates presented for 1980-86. A more accurate population estimate would include the marked plus observed animals. Using these animals and analysis area 1, a density estimate of 1 bear/51.9 km^2 (20.0 mi^2) is calculated as an average for 1980-86. This is very similar to density estimates of 1 bear/57.5 km^2 (22.2 mi^2) in fall reported by Aune et al. (1984). Spring concentration of grizzly bears may double densities of bears along the East Front spring range. Densities for each year ranged from 1 bear/44.5 km^2 (17.2 mi^2) in 1982 and 1984 to 1 bear/56.4 km^2 (21.8 mi^2) in 1981, 1983 and 1986.

Density estimates were calculated in 1986 for the marked plus observed population. Highly visible marks were not placed on each animal and marks were also lost. Our data only allowed imprecise estimates of the minimum - maximum marks present on the study area from 1984-86. Because new marks have not been placed on animals since 1983 our population data from the core area has become less reliable. Our inclusion of data from this period 1984-86 in all population tables is to demonstrate the minimum information available for those years.

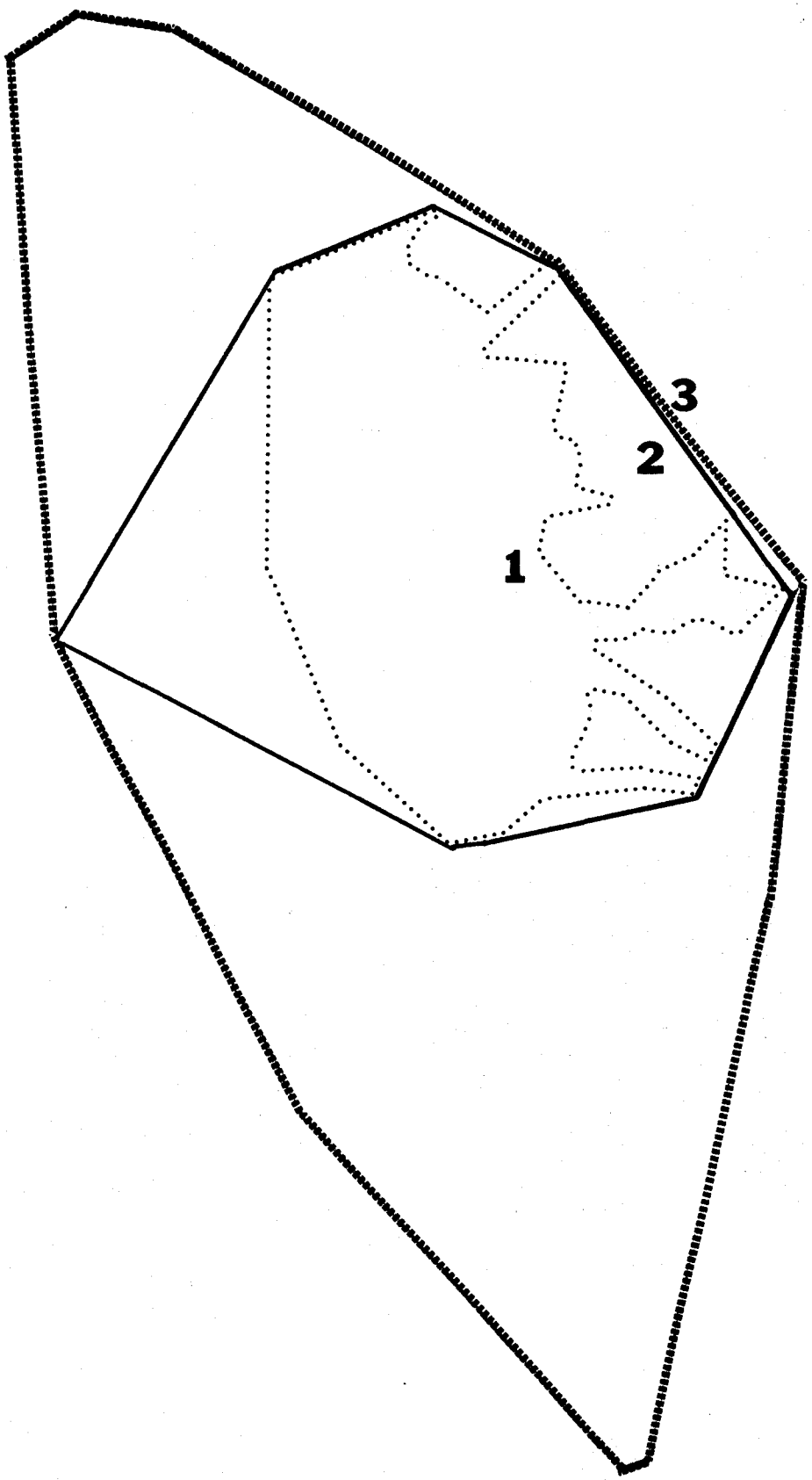

Figure 35. Composite home range options for density analysis, 1977-85.

Table 33. Density estimates for the Deep Creek-Birch Creek core study area, 1980-86.

Year	(A) Marked Population	(B) Marked + Observed	Area 1 (1467 km²) Density A	Area 1 (1467 km²) Density B	Area 2 (2862 km²) Density A	Area 2 (2862 km²) Density B	Area 3 (6471 km²) Density A	Area 3 (6471 km²) Density B
1980	16	27	91.7	54.3	178.9	106.0	404.4	239.7
1981	18	26	81.5	56.4	159.0	110.1	359.5	248.9
1982	20	33	73.4	44.5	143.1	86.7	323.6	196.1
1983 1/	22	26	66.7	56.4	130.1	110.1	294.1	248.9
1984 1/	25-28	33	58.7-52.4	44.5	114.5-102.2	86.7	258.8-231.1	196.1
1985 1/	20-23	29	73.4-63.8	50.6	143.1-124.4	98.7	323.6-281.3	223.1
1986 1/	9-21	26	No. est.	56.4	No est.	110.1	No est.	248.9
	Average		74.2-71.6	51.9	144.8-139.6	101.2	327.3-315.6	228.8

Area 1: Adult Bear Polygon consisting of 98% locations excluding unsuitable eastern habitats and subadult bears, 1977-84.

Area 2: Adult outside Polygon, subadults excluded 1977-84.

Area 3: Total outside Polygon 1977-84 all bears included.

(A): Min. marked population estimate.

(B): Marked plus observed bears population estimate.

1/ Significant decrease in field work intensity.

8072/2

Minimum Counts

Minimum counts were conducted in three areas of the East Front. These data represent minimum numbers of bears sighted and are not to be considered population estimates for the entire front. All counts included only verified sightings of bears by field personnel and other biologists in the areas.

As discussed previously, a total count of 26 grizzlies was made for the area from Deep Creek to Birch Creek. No records were included in this area from the areas west of the Sun River where track records, etc. indicate many bears exist.

In the north-half of the Badger-Two Medicine area, 8 different grizzlies were observed in 1986. These included 5 marked bears, 2 cubs of a marked female, and 1 unmarked male. Tracks indicated that 1 other adult female with at least 1 yearling cub was in the area.

South of the Sun River, 12 different bears were observed. These included marked bears 355, 301, 316, 412, 410, 101 and two 2-year old cubs of bear 301. Three unmarked males and 1 unknown sex adult grizzly were also sighted.

Over all a total of 46 different grizzlies were sighted on the East Front in 1986. In comparison 41 grizzlies were observed in 1983, 52 in 1984, and 50 in 1985. From the period 1983-86 an average of 47.3 grizzlies were observed annually.

Production Data

Production as recorded by observations of females with cubs has been very poor south of the Sun River (Table 34). In contrast records north of the Sun River show an average minimum production of 7.8 cubs per year (Table 35). Evidence gathered from observations of females with yearlings in 1986 were included in data for 1985. A radio collared female was observed with 3 yearlings in 1986 as well as a female (possibly a marked bear) with 2 yearlings. We assume that these bears were present in 1985 although not observed during that year.

Table 34. The number of cubs with each female observed in the study area south of the Sun River, 1980-86.

Year	No. Females	No. Cubs	Average Litter
1980[1/]	1	2	2.00
1981[1/]	0	0	0.00
1982[1/]	0	10	0.00
1983	1	1	1.00
1984	2	13	1.50
1985	0	0	0.00
1986	0	0	0.00
TOTAL	4	26	1.5

[1/] Intensive field efforts did not begin in this area until 1983.

Table 35. The number of cubs with each female observed in the study area north of the Sun River, 1980-86.

Year	No. Females	No. Cubs	Average Litter
1980	3	7	2.33
1981	1	2	2.00
1982	4	11	2.75
1983	2	5	2.50
1984	6	15	2.50
1985[1/]	2	5	2.50
1986	3	8	2.67
TOTAL	21	53	2.52

[1/] Data changed from 1985 to reflect observation of 2 females in 1986 with 5 yearlings (one was radio-marked).

A total of 80 cubs were sighted in 35 litters since 1976 for an average litter size of 2.29 cubs (Table 36). Craighead et al (1974) reported a mean litter size of 2.24 in Yellowstone National Park while Knight and Eberhardt (1985) report an average litter size of 1.9 in the same area. Elsewhere in Montana, litter sizes ranged from 2.12 in the Mission Mountains to 2.66 along the N. Fk. of the Flathead River (Dood et al 1986). The average yearling litter size recorded in observations from 1976-86 was 2.09 (Table 37). This was not significantly lower than the average litter size for cubs (T=0.80, 0.5 less than P less than 0.2 df=10). The yearling litters from each year (1981-85) when projected back one year account for 98% of the cub litters reported for 1980-85. This suggests that most cubs seen in one year for 1980-85 were observed again the following year as yearlings. Prior to 1980 records were less consistent and suggest fewer cubs were observed in one year (70% of the yearling population the next year) than yearlings the next year.

Table 36. The number of females with cubs observed in the entire East Front area, 1976-86.

Year	No. Females	No. Cubs	Average Litter
1976	3	5	1.67
1977	2	5	2.50
1978	4	9	2.25
1979	1	2	2.00
1980	4	9	2.25
1981	1	2	2.00
1982	4	11	2.75
1983	3	6	2.00
1984	8	18[1/]	2.25[1/]
1985	2	5[2/]	2.50[2/]
1986	3	8	2.67
TOTAL	35	80	2.29

Table 37. The number of females with yearling cubs observed in the entire East Front area, 1976-86.

Year	No. Females	No. Cubs	Average Litter
1976	8	16	2.00
1977	6	11	1.83
1978	4	8	2.00
1979	3	6	2.00
1980	2	5	2.50
1981	4	9	2.25
1982	1	2	2.00
1983	5	11	2.20
1984	2	5	2.50
1985	9	18	2.00
1986	2	5	2.50
TOTAL	46	96	2.09

Mortality

Total known grizzly mortalities since 1977 along the East front consists of 32 bears (Table 38). Twenty-two of these mortalities occurred north of the Sun River. Man-caused mortalities include 30 bears. One mortality (#372) cause was undetermined and one was natural (410). Of these mortalities, 20 (67%) were nonhunting while 10 (33%) were hunting mortalities (Table 39). A skew toward nonhunting mortalities was again observed in 1986 when a limited hunting season was experienced.

Males accounted for 69% of the mortalities and females 31%. Less than one female mortality per year has been reported since 1977. Subadults accounted for 58% of the mortality while adults comprised 42% of the total mortality.

The amount and type of mortality experienced by grizzly bears on the study area since 1977 has changed dramatically. From 1977-83 grizzly mortality averaged 2.3 bears per years. Fifty percent of the mortality was caused by sport hunting and 12.5 percent was illegal man-caused mortality. From 1984-86 grizzly mortality averaged 5.3 bears per year. Forty-four percent of the mortality in this later period was illegal man-caused mortality. Only two hunting mortalities (12.5%) occurred from 1984-86 as there were very short seasons in 1984 and 1986 and no season during 1985.

Black Bear Studies

Black bears and grizzly bears are sympatric on the Rocky Mountain Front. Since they are closely related species, some black bear information was accumulated incidental to the ongoing grizzly bear monitoring program. Results of studies of black bears from 1981-86 are summarized in this report.

Table 38. Age and sex data from 32 grizzlies lost from the Northern Continental Divide Ecosystem along the East Front, 1977-86.

Bear No./Record No.	Age	Sex	Date	Location	Cause
Marked					
110[1]	2.5	F	6/77	Blackleaf	Livestock Depredation
531[1]	3.5	M	5/78	Muddy Creek	Livestock Depredation
229[2]	10.5	M	10/21/79	Elk Creek	Hunting
271[2]	7.5	M	10/79	North Fork Sun River	Illegal
332[2]	16.0	M	1/17/79	Elk Creek	Livestock Depredation
347[2]	4.5	M	8/80	Alice Creek	Livestock Depredation
348[2]	4.5	M	7/29/80	Caddotte Creek	Livestock Depredation
430-431[1]	3.5	F	10/80	Badger Creek	Livestock Depredation
540-510[1]	15+	F	10/81	North Fork Sun River	Hunting
519[1]	1.5	M	10/30/82	Teton	Hunting
529[1]	2.5	M	11/12/82	North Fork Sun River	Hunting
550[1]	3.5	M	10/1/83	S. Fk. Flathead River	Hunting/Livestock Depredation
273[1]	10.5	F	9/23/84	Teton	Illegal
544[1]	4.5	M	9/?/84	Badger Creek	Illegal
518[2]	3.5	F	10/21/84	Teton	Hunting
282[1]	8.5	M	10/24/84	Dearborn	Hunting
372[1]	8.5	F	Fall 84	Sun River GMA	Unknown
306[1]	1.5	M	10/?/85	Blackfoot Res.	Illegal
342[1]	2.5	M	5/18/85	Bynum	Livestock Depredation
343[1]	1.5	M	6/12/85	Deep Creek	Livestock Depredation/Capture
101	3.5	F	6/?/86	Unknown[4]	Illegal
106	4.5	M	10/10/86	Blackleaf	Illegal
326	4.5	M	Fall 1985 or Spring 1986	Bear Creek	Illegal
341	2.5	F	5/14/86	Deep Creek	Nuisance
410	3.5	M	5/20/86	Smith Creek	Natural
498	9.5	M	6/24/86	N. Fk. Badger Creek	Capture

Table 38. Continued

Bear No./Record No.	Age	Sex	Date	Location	Cause
Unmarked					
1 2/	15+	F	11/8/77	Elk Creek	Hunting
2 1/	3.0	M	10/78	Badger Creek	Hunting
3 1/	1.5	M	10/25/81	Dupuyer Creek	Hunting
4 2/	Unknown	Unknown	11/81	Elk Creek	Illegal
5 1/	1.5	M	5/27/85	Teton	Mistaken I.D.
6 1/	1.5	M	6/11/85	Deep Creek	Capture

1 - Sun River north study area.
2 - Sun River south study area.
* - Relocated into Sun River fall 1980.
3 - Relocated to S. Fk. Flathead after livestock depredations then shot by hunter.
4 - Collar found on Blackfeet Indian Reservation.

8072/2

Table 39. Man-caused mortality summary for Rocky Mountain East Front grizzlies, 1977-86.

Year	Sun River North		Sun River South		Rocky Mtn. East Front		Total
	Non hunting	Hunting	Non hunting	Hunting	Non hunting	Hunting	
1977	1	0	0	1	1	1	2
1978	1	1	0	0	1	1	2
1979	1	0	1	1	2	1	3
1980	1	0	2	0	3	0	3
1981	0	2	1	0	1	2	3
1982	0	2	0	0	0	2	2
1983	0	1	0	0	0	1	1
1984	2	1	0	1	2	2	4
1985	5	0	0[1/]	0	5	0	5
1986	5	0	0[2/]	0	5	0	5
TOTALS	16	7	4	3	20	10	30

[1/] Loss of bear 372 was not included since cause of death is unknown.
[2/] Loss of bear 410 was not included since cause of death was natural.

Figures 36 and 37 present the distribution data for black bears along the East Front. The northern study area (Figure 36) lies north of the Sun River above T21N and East of R14W. The southern study area (Figure 37) lies south of the Sun River along the East Front, south of and including T21N and East of Range 14W. The core area extends from Deep Creek north toward Birch Creek; the western boundary is the eastern boundary of the Bob Marshall Wilderness. The area is described elsewhere in this report. Black bear trapping and observation data were collected for the entire East Front whereas radio telemetry studies were focused in the core area.

Trapping and Radiotracking

During 1986 trapping was conducted in six locales within the study area; the Badger-Two Medicine area, North Fork Badger Creek, Smith Creek - Willow Creek area, Fairview-Willow Creek area, Hoadley Creek, and Patricks Basin. There were 48 captures of 43 black bears in these areas (including 5 captures of 5 bears in management actions) (Appendix D). Twenty-nine (67%) of these bears were males and 14 (33%) were females. Twenty-two bears (51%) were adults (5.5 years old), 19 (44%) were subadults (2.5 to 5.5 years old) and 2 (5%) were cubs (Appendix D).

Seven black bears were captured, fitted with radio-collars and monitored during 1981-1984. By June 1, 1984 all collars were non-functional. No further black bears were collared, and radio-monitoring was not conducted in 1985 or 1986. Preliminary results from radio-locations of collared black bears relating to home ranges, denning, food habits and habitat use were previously presented (Aune et a. 1984).

Physical Characteristics

Physical measurements were recorded from each black bear captured in 1986 (Table 40). These data were combined with data from captures in previous years (Aune and Stivers 1981, 1982, 1983; Aune et al. 1984, 1986; Aune 1985) to provide for preliminary analysis of physical characteristics.

An ANOVA was conducted to determine if a relationship existed between female nipple length and age of first reproduction. There was a significant difference ($F=10.09$, $P=0.0003$, $N=24$) between ages in mean nipple length (Table 41). The SNK multiple range test indicated that females older than 2 years had a mean nipple length greater ($P=0.05$) than those 2 years or younger.

Although the analysis we conducted only indicate a statistically significant difference in mean nipple length between 2 year olds or younger and those older, a biological difference was apparent at age 5.0 years. Although the data indicates that mean nipple length at age 5.0 years was 11.2 mm and at age 8.0 years was 9.7 mm (Table 41), two exceptions should be noted. First, black bear 331 had not yet produced cubs at 5.0 years old when her nipple length was 9.7 mm, but at age 7.0 after producing her first litter at age 6.0, her nipple length was 16.0 mm. If we exclude her from the analysis at age 5.0 years, then

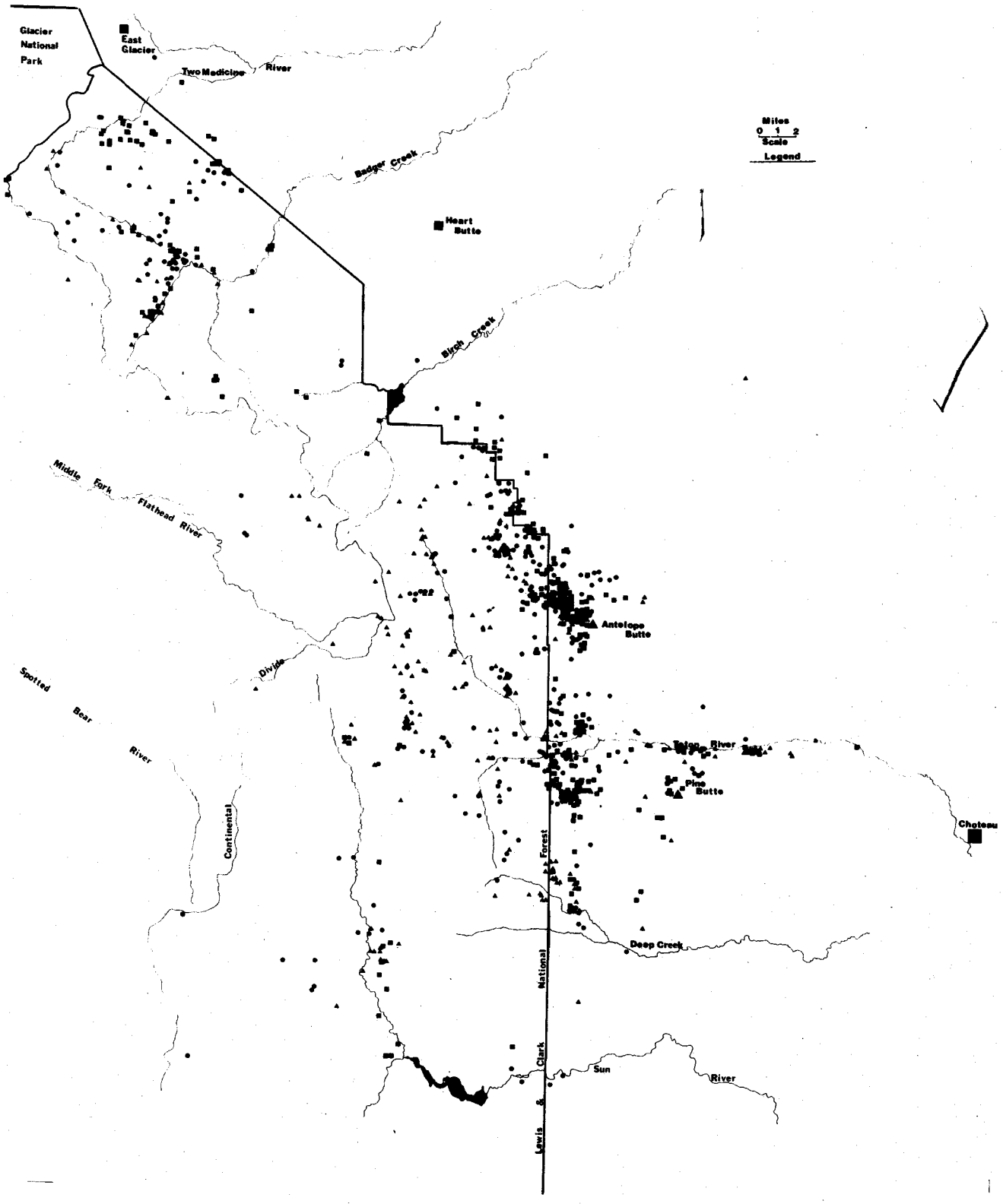

Figure 36. Black bear distribution 1976-86, for the Rocky Mountain Front study area north of the Sun River.

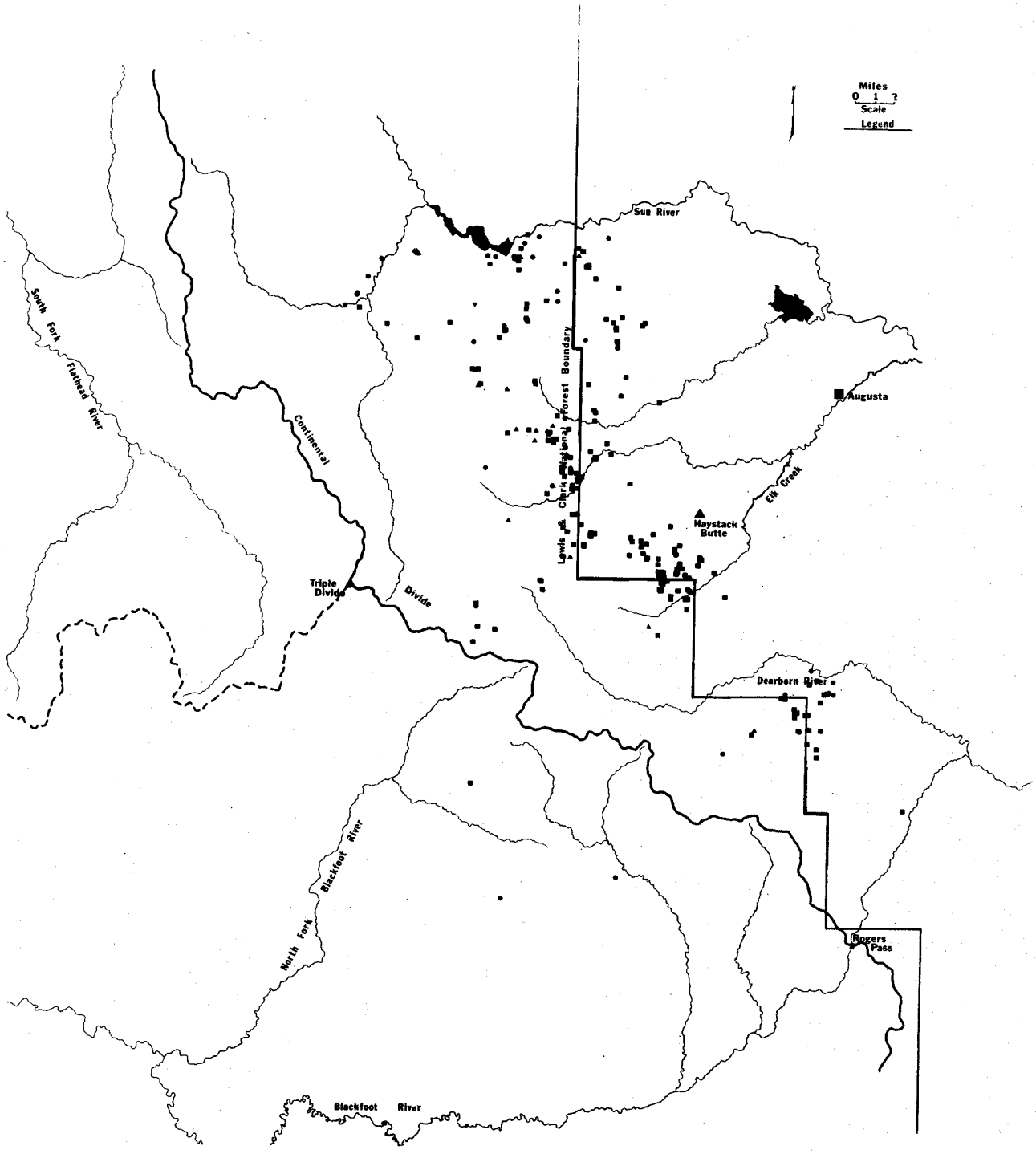

Figure 37. Black bear distribution 1976-86, for the Rocky Mountain Front study area south of the Sun River.

Table 40. Black bears captured on the Rocky Mountain East Front study area, 1986.

Bear No.	Date	Age/Sex	Girth	Weight		Coat	Front Foot Pad	Back Foot Pad	Ear Tags-(roto tags)		Lip Tattoo	Capture
				Scale	Color	Length x Width (in)	Length x Width (in)	Left-No/Color	Right-No/Color	No/Color		Location
102	8/30	3.5/M	60	105	Brown	2.25 x 3.63	5.25 x 3.75	102/Yellow	102/Yellow	102/Black		Teton River
103	8/30	cub/F	-	40	Black	1.75 x 3.00	4.00 x 2.75	103/Yellow	103/Yellow	103/Black		Teton River
104*	8/30	cub/M	-	50	Black	2.00 x 3.13	4.00 x 3.00	104/Yellow	104/Yellow	104/Black		Teton River
105	9/11	13.5/F	108	115	Black	2.38 x 3.75	5.00 x 3.25	105/Yellow	105/Yellow	105/Black		Sun River
309	5/23	8.5/M	182	180	Black	4.75 x 2.25	4.25 x 6.00	309/Green	309/Green	309/Green		Smith Creek
311	5/17	5.5/M	124	-	Black	2.63 x -	5.63 x -	311/Green	311/Green	311/Green		Smith Creek
331	5/16	7.5/F	67	105	Brown	2.00 x -	4.75 x -	331/Green	331/Green	331/Green		Ford Creek
356	5/29	4.5/F	89	90	Black	2.00 x 3.63	3.38 x 4.75	356/Green	356/Green	356/Black		Little Badger Cr.
390	6/23	14.5/M	229	240	Brown	5.25 x 2.75	5.00 x 6.38	390/Green	390/Green	390/Black		Fairview Cr.
403	5/16	6.5/M	89	160	Black	2.38 x 3.75	5.38 x 6.88	403/Green	403/Green	403/Green		Willow Cr.
404*	5/21	1.5/F	-	27	Blonde	3.00 x 1.50	3.00 x 4.00	404/Green	403/Green	403/Green		Ford Cr.
405*	5/16	4.5/F	98	115	Black	2.38 x -	5.00 x -	405/Green	403/Green	403/Green		Smith Cr.
406	5/19	3.5/M	82	-	Brown	2.38 x 3.75	5.13 x 3.38	406/Green	403/Green	403/Green		Smith Cr.
407	5/15	3.5/M	56	85	Brown	2.13 x -	4.88 x -	407/Green	403/Green	403/Green		Smith Cr.
408	5/20	4.5/M	130	150	Brown	2.38 x 4.25	5.88 x 4.13	408/Green	403/Green	403/Green		Willow Cr.
409	5/21	13.5/F	98	-	Brown	2.13 x 3.88	4.75 x 3.5	409/Green	403/Green	403/Green		Ford Cr.
413	5/24	2.5/M	81	95	Black	2.13 x 4.25	5.00 x 4.00	413/Green	403/Green	403/Green		Willow Cr.
414	5/24	1.5/M	-	40	Brown	1.75 x 3.5	4.25 x 3.25	414/Green	403/Green	403/Green		Willow Cr.
415	5/26	1.5/M	-	-	Brown	2.00 x 3.25	4.13 x 3.00	415/Green	403/Green	403/Green		Ford Cr.
416*	5/27	3.5/M	62	80	Brown	2.25 x 3.88	4.63 x 3.38	416/Green	403/Green	403/Green		Petty Cr.
417*	6/23	7.5/F	85	120	Black	2.00 x 4.25	5.13 x 4.00	417/Green	403/Green	403/Green		Fairview Cr.
418	6/27	12.5/M	197	240	Brown	2.25 x 4.63	6.00 x 4.38	418/Green	403/Green	403/Green		Fairview Cr.
427	9/10	8.5/M	189	-	Brown	3.25 x 4.50	5.75 x 4.50	427/Green	403/Green	403/Green		Windfall Cr.
428	9/7	16.5/F	103	150	Black	2.25 x 3.50	5.00 x 3.50	428/Green	403/Green	403/Green		Sheep Sheds Mtn.
434*	9/12	4.5/M	108	160	Brown	3.00 x 4.38	6.50 x 4.25	434/Green	403/Green	403/Green		Windfall Cr.
437*	9/6	10.5/M	127	190	Brown	2.75 x 4.50	6.00 x 4.25	437/Green	403/Green	403/Green		Windfall Cr.
457*	5/28	12.5/F	130	110	Black	2.50 x 3.88	4.88 x 3.63	457/Green	403/Green	457/Black		Badger Cr.
458*	5/25	2.5/M	83	-	Black	2.38 x 4.00	5.13 x 3.50	458/Green	403/Green	458/Black		Little Badger Cr.
459	5/18	4.5/M	127	147	Brown	2.75 x 4.25	5.88 x 4.00	459/Green	403/Green	459/Black		Badger Cr.
461	5/29	6.5/M	197	195	Black	3.13 x 4.63	6.50 x 4.38	461/Green	403/Green	461/Black		Badger Cr.
462	6/19	-/M	85	105	Brown	2.50 x 3.88	5.38 x 3.50	462/Green	403/Green	462/Black		Badger Cr.
463	6/29	9.5/M	143	160	Black	2.63 x 4.38	6.25 x 4.00	463/Green	463/Green	463/Black		Crucifixion Cr.
468	6/17	3.5/M	77	85	Brown	2.25 x 4.00	5.00 x 3.63	468/Green	463/Green	468/Black		Muskrat Cr.
469	6/28	6.5/M	130	85	Brown	2.88 x 4.75	6.00 x 4.75	469/Green	463/Green	469/Black		Kip Cr.

8072/2

Table 40. Black bears captured on the Rocky Mountain East Front study area, 1986.

Bear No.	Date	Age/Sex	Girth	Weight Scale	Coat Color	Front Foot Pad Length x Width (in)	Back Foot Pad Length x Width (in)	Ear Tags-(roto tags) Left-No/Color	Ear Tags-(roto tags) Right-No/Color	Lip Tattoo No/Color	Capture Location
471	6/23	9.5/F	100	125	Black	2.75 x 4.00	5.00 x 3.75	471/Green	463/Green	471/Black	Kip Cr.
472	6/12	3.5/M	110	-	Black	2.75 x 4.38	5.63 x 3.88	472/Green	463/Green	472/Black	Badger Cr.
473	5/21	4.5/M	140	140	Brown	2.75 x 4.25	5.88 x 3.88	473/Green	463/Green	473/Black	Little Badger Cr.
474	6/28	3.5/M	56	70	Brown	2.00 x 3.75	5.00 x 3.25	474/Green	463/Green	474/Black	Muskrat Cr.
482	7/10	3.5/F	74	70	Brown	2.13 x 4.50	5.00 x 3.63	482/Green	463/Green	482/Black	N. Fk. Badger Cr.
520	5/26	6.5/M	153	-	Brown	2.75 x 4.75	6.25 x 4.50	470/Green	520/Red	520/Black	Badger Cr.
525	5/25	7.5/F	98	-	Black	2.25 x 3.50	5.00 x 3.25	-	525/Red	525/Green	Smith Cr.
530	5/17	9.5/M	197	230	Brown	2.88 x 4.75	6.00 x 4.38	-	354/Green	354/Green	Smith Cr.
401	8/28	7.5/F	155	180	Black	-	5.88 x 4.38	401/Green	426/Green	426/Green	S. Fk. Teton R

*Hunter killed 1986

Table 41. Mean teat length and diameter by age for female black bears on the Rocky Mountain East Front, 1976-1986.

Age	Teat Length (mm)	N	Teat Diameter (mm)	N	Observed Lactation
1	3.3	1	3.3	1	No
2	4.5	5	7.7	5	No
3	9.7	1	9.7	1	No
4	9.1	3.	7.5	3	No
5	11.2	2	12.8	2	No
6	15.9	2	8.0	2	Yes
7	15.9	3	9.7	3	No
8	9.7	1	9.7	1	No
9	12.7	1	9.7	1	Yes
12	12.7	1	6.4	1	No
13	12.7	2	9.5	2	Yes
16	16.0	1	9.7	1	No
20	25.1	1	12.7	1	Yes

the mean nipple length for age 5.0 years was 12.7 mm. Second, bear 336 was captured at 8.5 years of age without any young and a nipple length of 9.7 mm. When captured she showed no evidence of having previously suckled young. Excluding bears 331 and 336, of the remaining 22 females captured, all bears older than 5.0 years had a nipple length of at least 12.7 mm and all bears younger than 5.0 years had nipple lengths of 9.7 mm or less. Kasworm (1986) reported that a nipple length of at least 12 mm for black bears appeared to indicate previous production of young. Our analysis support this suggestion.

Black bear female 331 had not yet produced cubs when captured in 1984 at the age of 5.5 years. She was recaptured in 1986 at the age of 7.5 years and had yearlings with her, indicating she had produced her first litter at the age of 6.0 years. Jonkel and Cowan (1971) reported the age at first reproduction as 6.0 to 7.0 years in Montana. Collins (1973) reported that 80% of the black bears in North Carolina produced first litters at age 4.0 years. Reynolds and Beecham (1980) reported a mean age at first reproduction of 4.8 years in Idaho.

Using data from black bear captures in 1986 (Table 40 and from previous years (Aune and Stivers 1981, 1982, 1983; Aune et al. 1984, 1986; Aune 1985) we derived equations for predicting body weight for males, females and both sexes combined. We used two regressions for predicting weight, the first is a $\log_{10}$ - $\log_{10}$ regression of chest girth and weight, the second is a regression of a body index (body length times chest girth squared) and weight (McLellan 1982). The fit (as determined by the coefficient of determination) varies with the regression used and the sex class (Table 42). The best fit is for males (r^2=0.93) regressing $\log_{10}$ chest girth against $\log_{10}$ weight. These analysis indicate that it may be possible to estimate body weight using these equations when scale weight is not possible or is impractical to obtain. Relationships between chest girth and body weight have been reported for all species of North American bears (Payne 1976, LeCount 1977, Stirling et al. 1977, Glenn 1980, Kingsley et al. 1983, Nagy et al. 1984, Waddell and Brown 1984).

Table 42. Equations for predicting live weights of black bears on the Rocky Mountain East Front.

Sex	Equation[a]	r^2	N
All bears	W=4.486 + 0.0000606I	0.92	82
	$W=-2.81046G^{2.415}$	0.92	82
Males	W=6.571 + 0.0000596I	0.92	60
	$W=-2.64855G^{2.335}$	0.93	60
Females	W=4.689 + 0.0000569I	0.83	22
	$W=-2.98702G^{2.492}$	0.85	22

[a]W=Body weight, I=Body index (body length times chest girth squared), G=Chest girth.

An ANOVA by age was used to determine if testes length or width, or baculum length could be used to estimate sexual maturity in males. The results indicated that a significant difference existed for mean testes length (F=11.77, P=0.0001, N=117), mean testis width (F=9.01, P=0.0001, N=117), and mean baculum length (F=14.40, P=0.0001, N=116) but the SNK multiple range test failed to reveal any biological significance for these measurements in determining sexual maturity. Plots of these mean measurements (Figure 38), however, indicated that they may be useful as a measure of growth.

Distribution, 1976-1986

Maps of black bear distribution on the East Front were developed from radio-locations, trapping, sightings, and bear sign collected during 1976-1986 (Figures 36 and 37). Table 43 displays the distribution data by observation type. A total of 1,226 observations have been recorded; 80% of the data were from observations in the northern study area (Figure 37). This difference probably does not reflect population differences, but is due instead to the focus of bear studies on the East Front which have been concentrated on grizzly bears and incidental black bear observations in areas north of the Sun River.

Home Ranges

Home ranges were mapped for 7 black bears monitored between 1981 and 1984 (Figures 39-45). Black bear 288, an adult male cast his collar in August 1982 only 3 months after being instrumented. Therefore, his home range was probably underestimated.

The minimum home range area for adult males in this study (Table 44) was considerably larger than in the Cabinet Mountains, Montana (66.9 km^2, Kasworm 1986) and the East Boulder River, Montana (152 km^2, Rosgaard and Simmons 1982). Adult female home range area was also considerably larger in this study than reported by Kasworm (1986) (16.4 km^2) or by Rosgaard and Simmons (1982) (6.5-35.2 km^2). Home range sizes for both sexes are larger in the present study than for other populations in North America (Table 45) Amstrup and Beecham

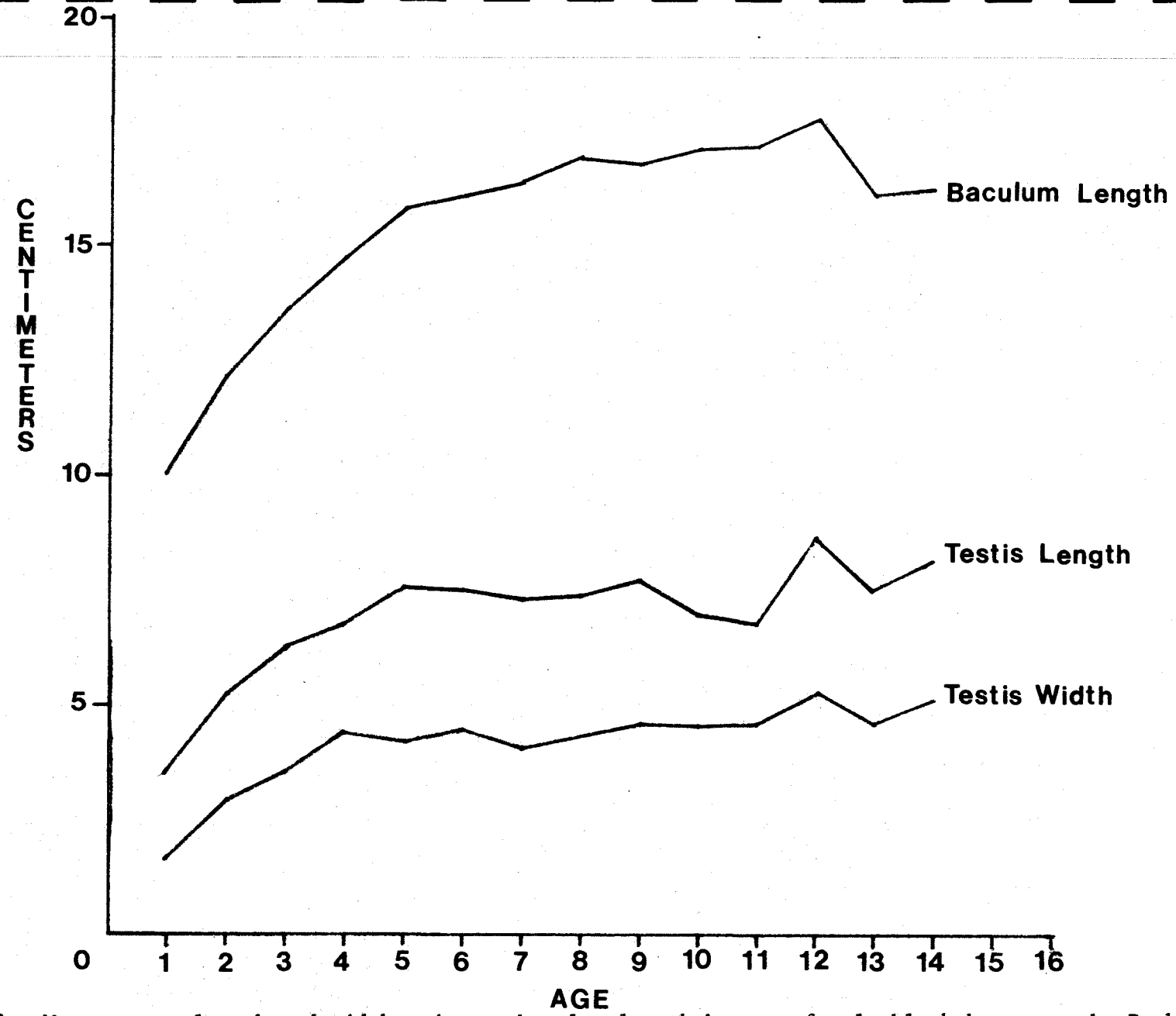

Figure 38. Mean testes length and width and mean baculum length by age of male black bears on the Rocky Mountain East Front, 1976-86.

Table 43. Rocky Mountain East Front black bear observations by observation type, north and south of the Sun River, 1977-1986.

	Radio Location	Bear Sighting	Scat*	Track	Other	Trap Site	Total
1986							
North	0	20	1	8	2	23	54
South	0	12	0	3	0	25	40
1985							
North	0	16	4	6	4	0	30
South	0	5	3	8	0	14	30
1984							
North	23	53	18	5	0	9	108
South	0	14	25	5	0	47	91
1983							
North	163	50	36	15	0	2	266
South	0	21	10	7	0	25	63
1982							
North	124	42	73	34	0	12	285
South	0	3	1	1	0	0	5
1981							
North	48	50	51	0	4	7	170
South	0	1	1	1	0	0	3
1980							
North	0	20	2	1	0	10	33
South	0	4	0	0	0	0	4
1977-1979							
North	0	6	3	1	1	30	41
South	0	1	0	0	0	2	3
TOTAL	358	318	228	105	11	206	1226
North	358	257	188	80	11	93	987
South	0	61	40	25	0	113	239

*This category does not include scats collected at trap sites, radio-location sites, or any scat known to be from a marked bear.

8072/2

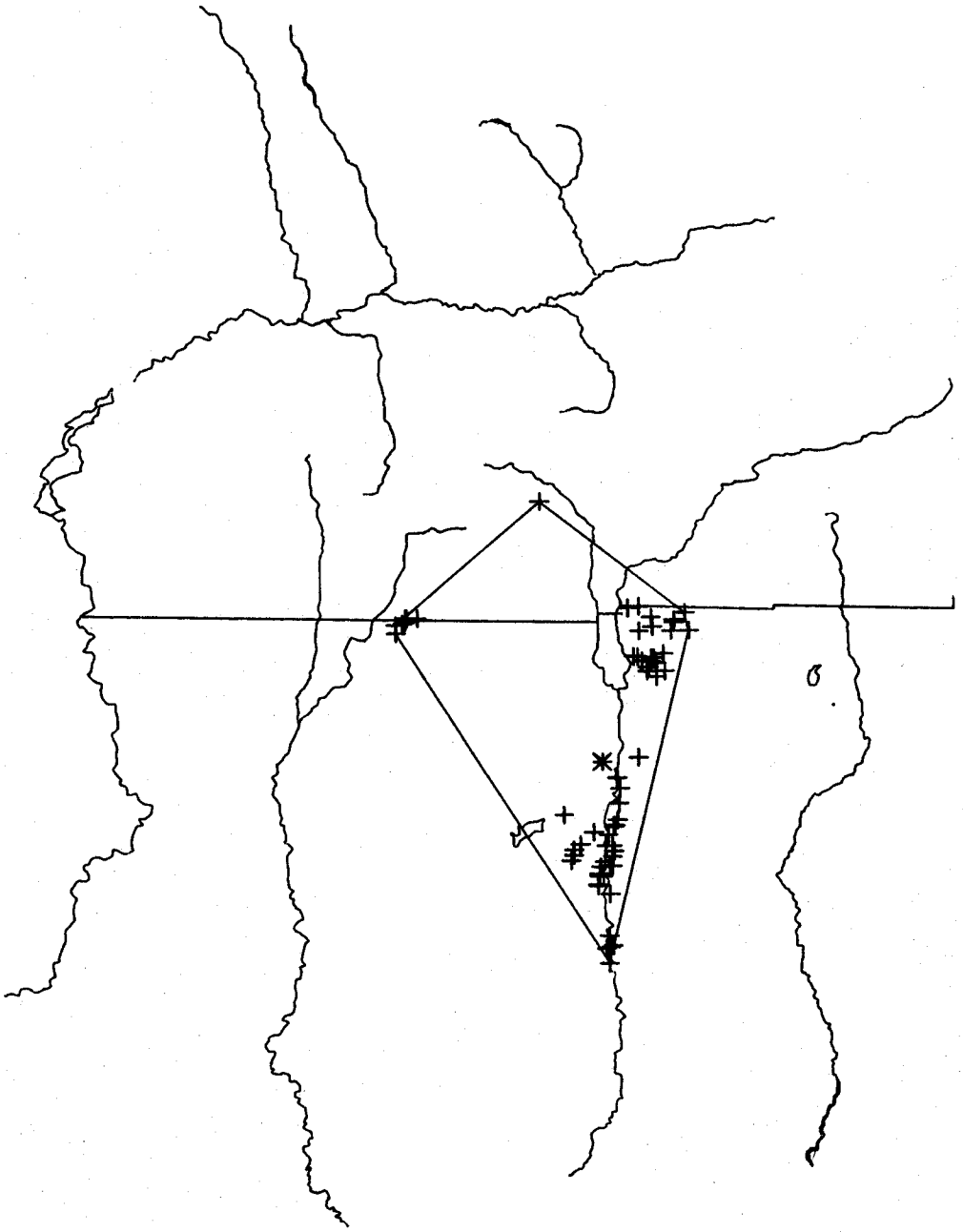

Figure 39. Home range of female black bear 523, 1981-84.

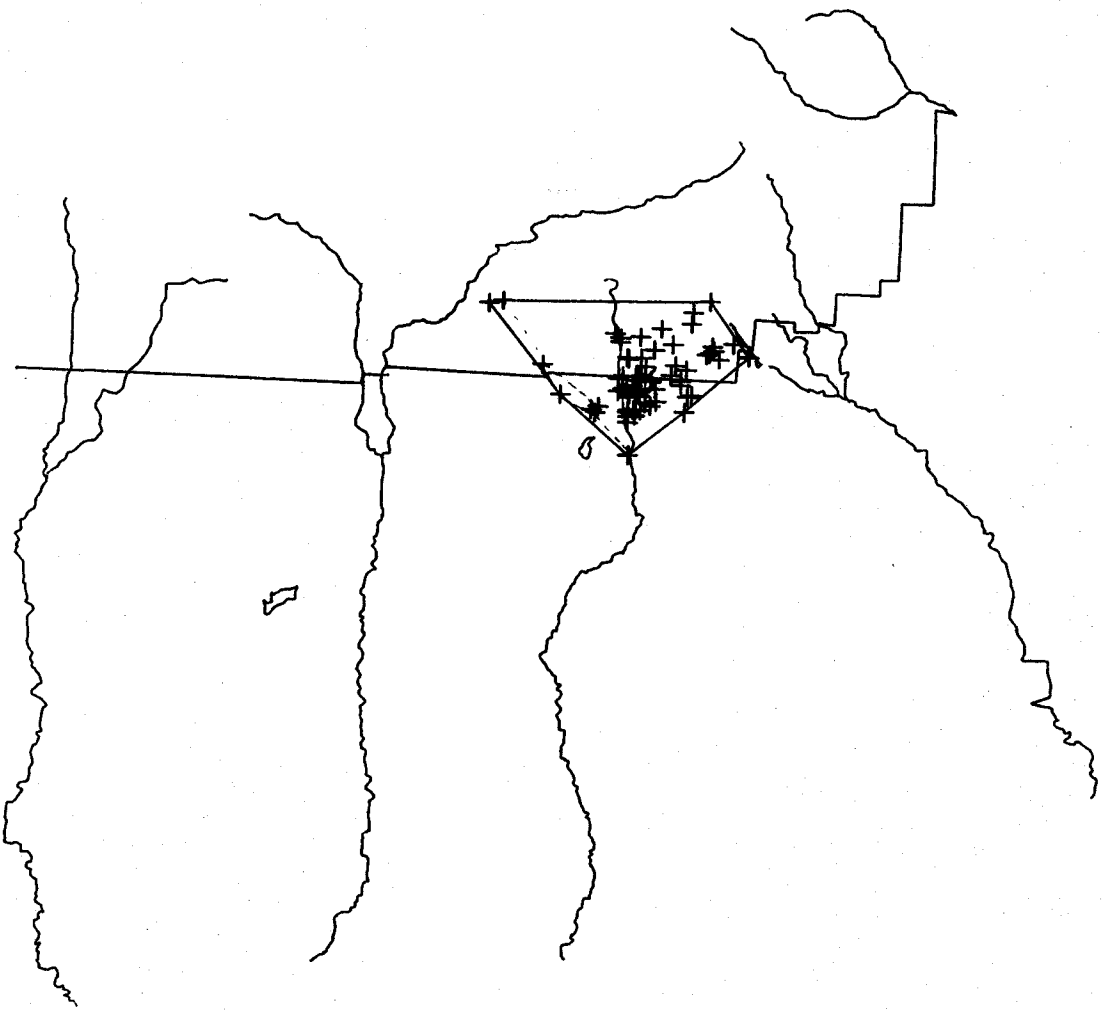

Figure 40. Home range of female black bear 509, 1981-84.

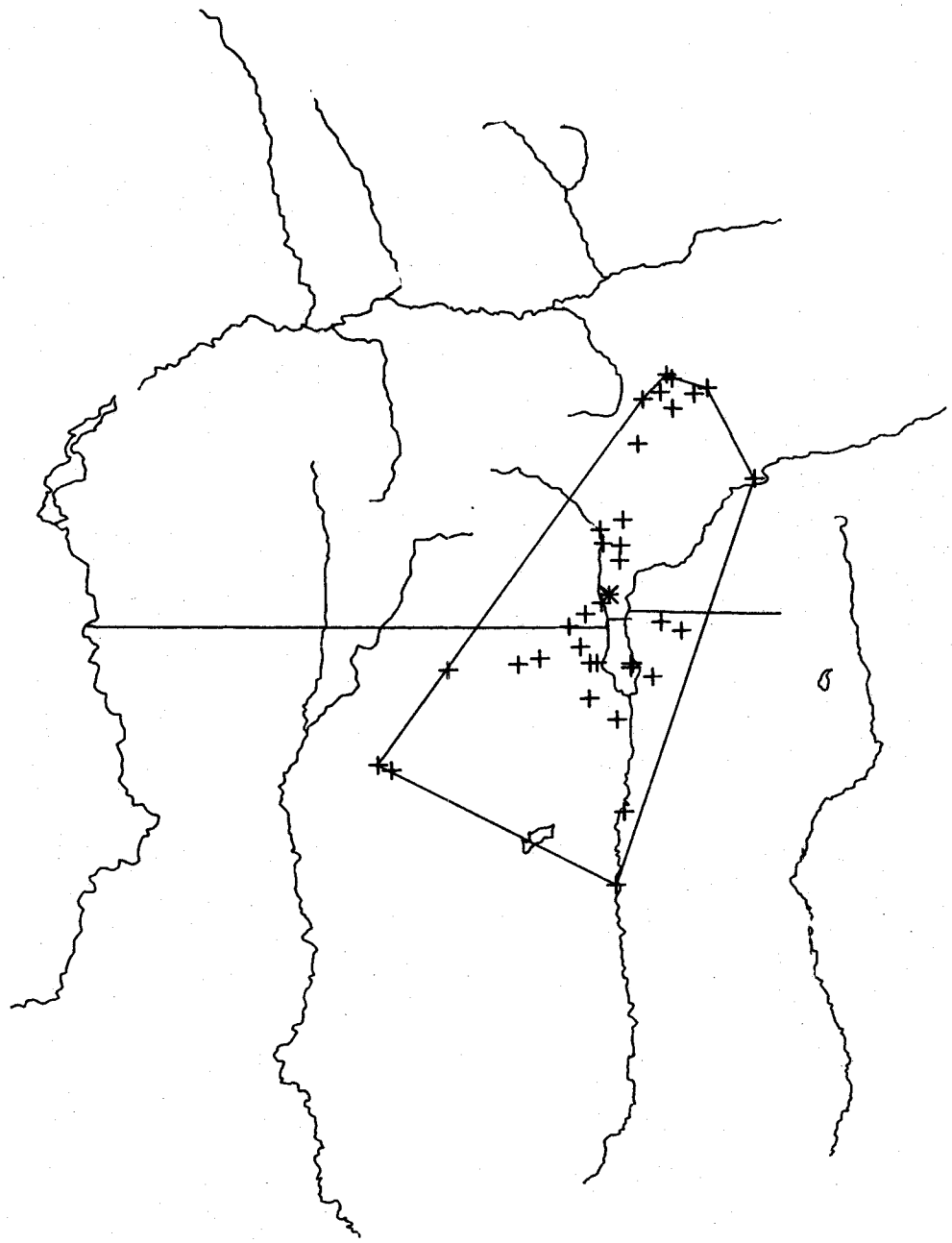

Figure 41. Home range of male black bear 506, 1981-84.

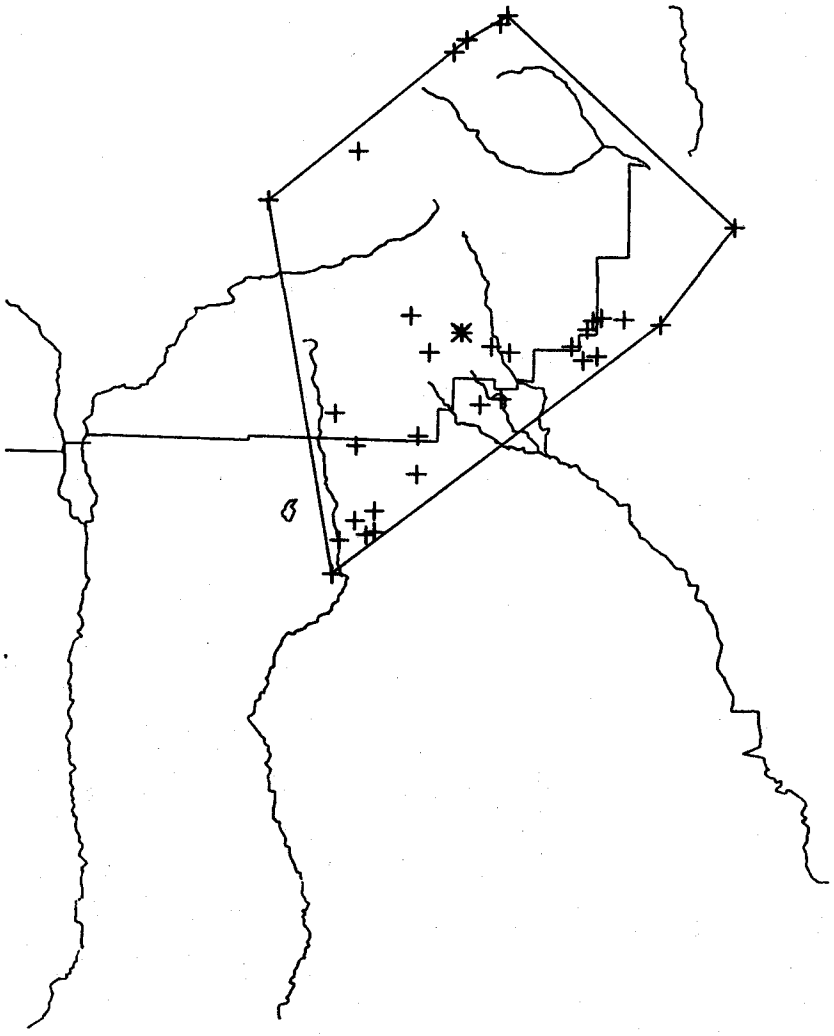

Figure 42. Home range of male black bear 212, 1981-84.

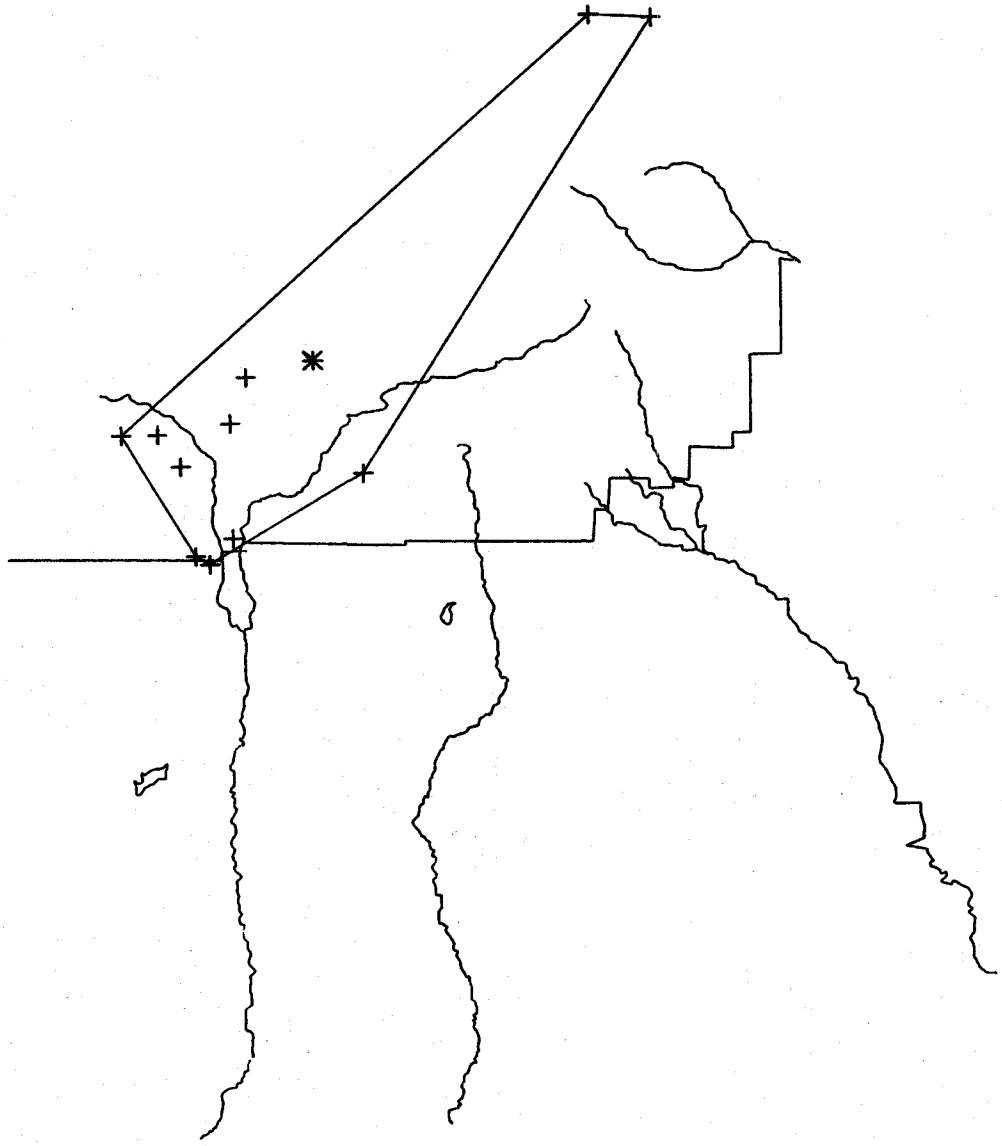

Figure 43. Home range of male black bear, 288, 1982.

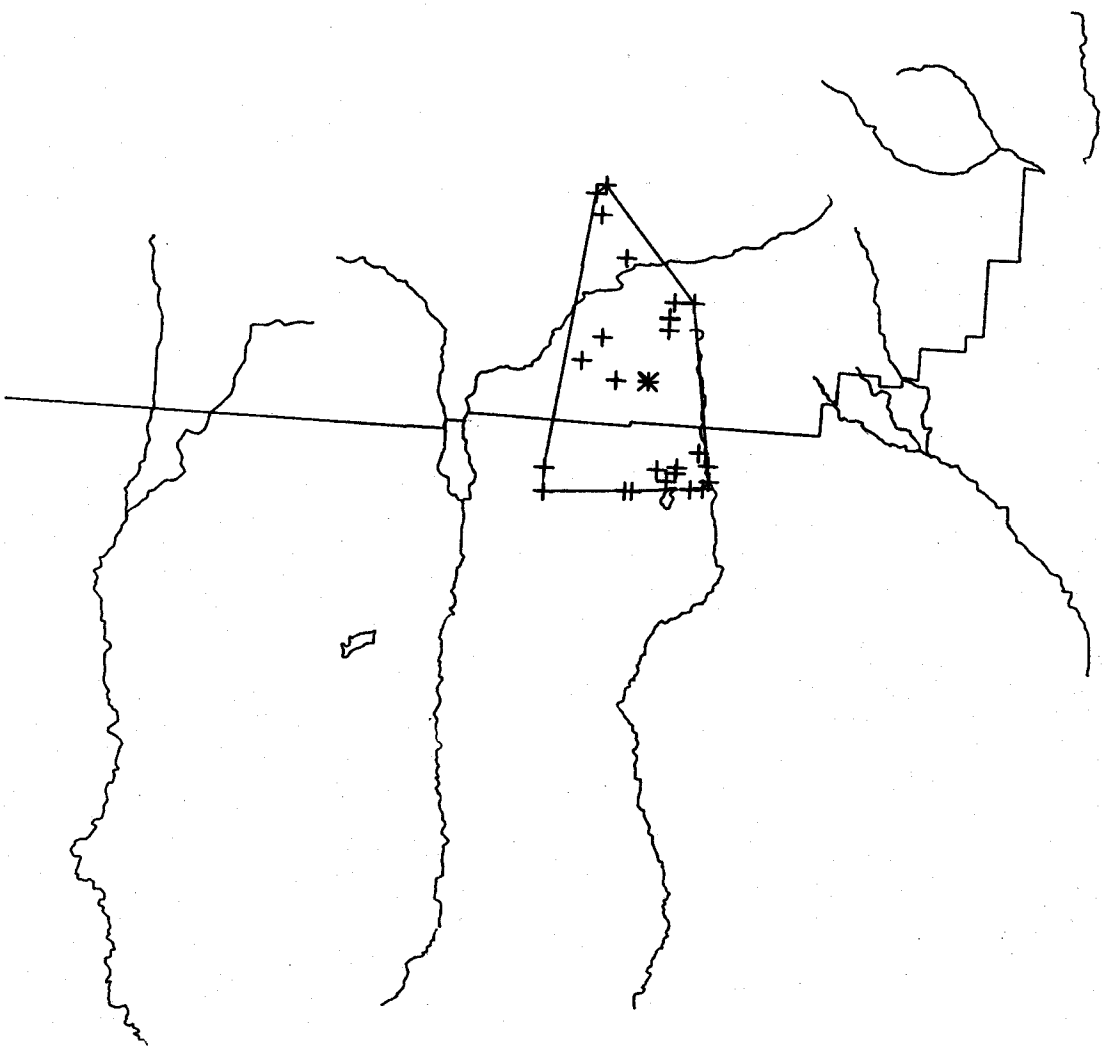

Figure 44. Home range of male black bear 515, 1983-1984.

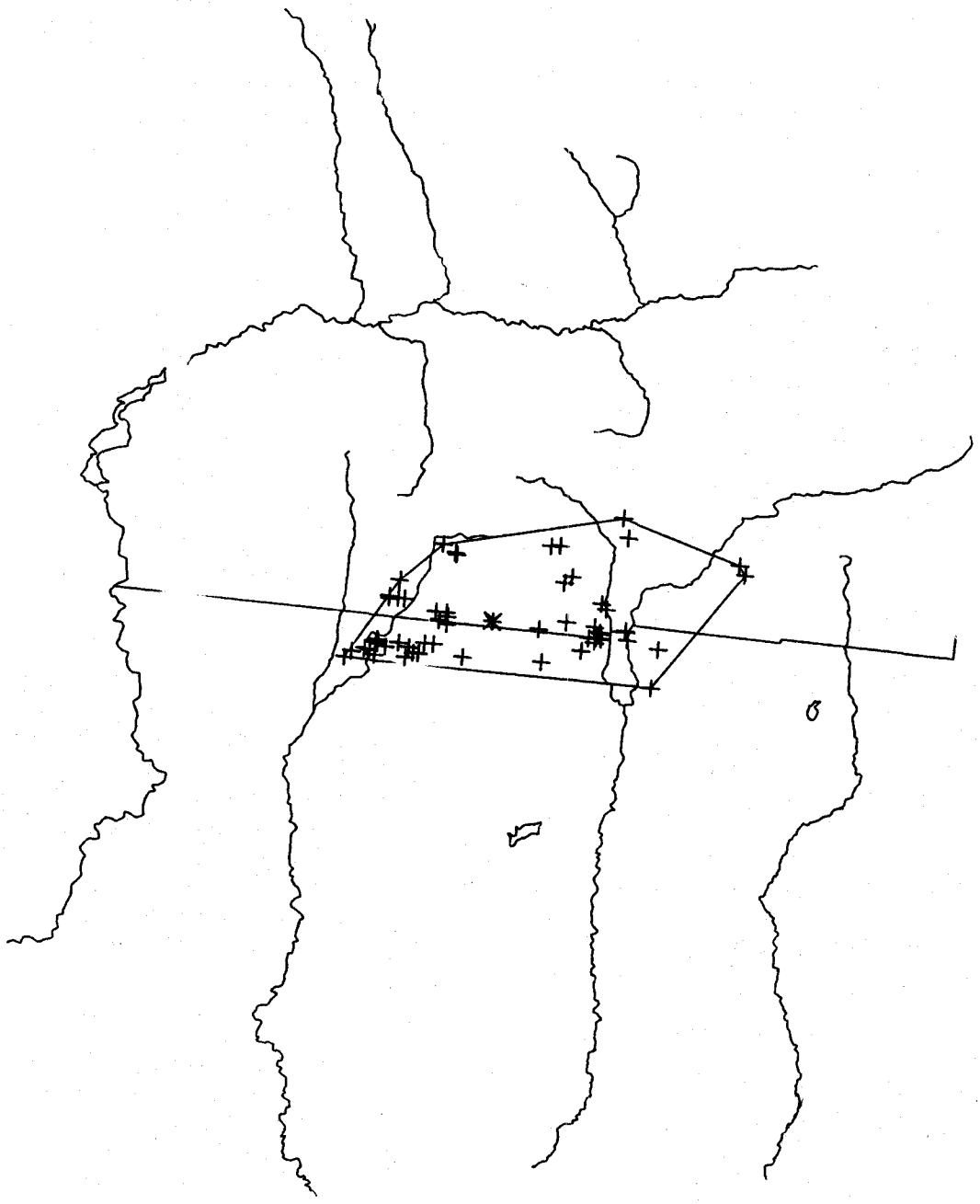

Figure 45. Home range of male black bear 517, 1982-84.

(1976) suggested that the quality, quantity and distribution of food, as influenced by climate and topography, probably determine home range size. On the East Front the climate is more arid than in many other areas of North America. Another factor in home range size of black bears could be interaction between grizzly and black bears. The influence of grizzlies on black bear home ranges is not known and no literature is available to support the hypothesis of grizzly influence on black bear home ranges.

Den Studies

A total of 14 black bear dens have been located within the study area (Table 46). Nine of these dens were examined from the ground. All of the inspected dens were dug. Black bear dens ranged in elevation from 1368-2267 meters for an average of 1716 m. Slopes of den sites ranged from 5-70 percent and averaged 32.6 percent. Black bear dens were found in 11 different habitat types and seven different land types.

Dates of den emergence and den entrance are presented in Tables 47 and 48. Black bears entered dens from October 13-November 30 and emerged from dens March 20-May 5.

Black Bear Food Habits

A total of 274 black bear scats were analyzed to determine black bear food habits (Table 49). Black bear scats contained food items from 9 major taxonomic groups including; mammals, insects, birds, tree's (pine nuts), sporophytes, forbs (including roots and corms), graminoids, shrubs (fruit), and debris. Bear food taxon were ranked according to percent frequency and percent which may reflect differences in food availability and seasonality (Table 50). Graminoids, forbs, and insects were the most common bear foods along the East Front and these foods had high percent frequency values. In contrast seasonally important or less common foods such as fruits, mammals, sporophytes, and Pine nuts had low percent frequency values. Graminoids, forbs, and fruit had the highest percent volume of all bear food taxon.

Domestic cattle and deer were the most common mammals eaten, as indicated by both frequency and volume. Other large herbivores in the scats of black bears were domestic sheep and elk. Insects and birds were present in black bear diets also. The major insect eaten was ants. As with grizzlies bird parts were infrequently found in scats and then most often during nesting season. Tardell and Doerr (1982) reported black bear depredations on bluebird nest boxes. Bluebird nest boxes and many ground nests of bird species are available to black bears along the Eastern Rocky Mountain Front.

In the vegetation eaten by black bears item parts selected varied with species. Berries and leaf parts were common items in shrub food species. Graminoids were primarily composed of stem or leafy parts. The forbs in black bear diets were mostly upper plant parts including leaf, stem, flowers, seeds, and fruit. Very little root matter was detected in analysis of black bear scats.

Table 44. Home range areas for black bears on the Rocky Mountain East Front, 1981-1984.

Bear No.	Sex	Age (1986)	Home Range Area (km^2) Minimum	Modified Minimum	No. of Locations	GAC[a] UTM (East)	(UTM (North)
212 (1981-1982)	M	7.5[b]	379.8	96.4	34	367656	5323785
288 (1982)	M	17.5[b]	239.3	62.7	12	363525	5308142
506 (1983-1984)	M	5.5[b]	268.2	86.9	36	372025	5303217
509 (1982-1983)	F	15.5[b]	69.3	32.1	79	373181	5317772
515 (1983-1984)	M	6.5[b]	92.8	19.3	27	370907	5313519
517 (1982-1983)	M	7.5[b]	143.9	92.6	62	373353	5296312
523 (1982-1984)	F	10.5	205.3	40.2	80	381385	5303259
Mean (N=5)	M	-	224.8	71.6	158	-	-
Mean (N=2)	F	-	137.3	36.2	149	-	-
Composite (N=7)	-	-	1136.1	714.4	330	373970	5308546

[a] - Geographic Activity Center
[b] - Age at death (See Appendix D)

Table 45. Mean home range areas for black bears in North America.[a]

Study Location	Home Range Area (km^2) Adult[b] Male	Female	Reference
Alaska	(79-100)[c]	(10-30)[c]	Modafferi (1982)
Alaska	153 (4-611)[d]	117[d]	Miller and McAllister (1982:98)
Alaska	141 (41-341)	21 (4-46)	Schwartz et. al. (1983)
Arizona	29 (15-69)	18 (10-30	LeCount (1977)
Idaho	105 (61-156)	18 (12-26)	Reynolds and Beecham (1977)
Idaho	112 (109-115)	49 (16-130)	Amstrup and Beecham (1976)
Washington (Island)	5 (2-13)	2 (1-4)	Lindzey (1976:39)
Washington (Mainland)	61 (13-87)	5 (3-6)	Poelker and Hartwell (1973:72)

[a] - Adopted from Schwartz et al. (1983) page 77.

[b] - Age greater than 3 years-old.

[c] - Includes all age classes.

[d] - Includes all bears greater than 2 years old.

Table 46. Data from 14 black bear dens, 1978-86.

Den No.	Location	Type of Den	Elevation (m)	Aspect (°)	Slope (%)	Habitat Type	Land Type	Rec. Yrs. Used	Bear No.	Condition
1	Glenn Cr.	Dug	1737	N350W	5	ABLA/LIBO/LIBO	111	1	Unknown	Old 1/
2	Muddy Cr.	Dug	1585	N20E	30	PSME/SYAL	140	1	Unknown	Good 1/
3	Muddy Cr.	Dug	1625	N60E	16	PSME/SPBE	140	1	Unknown	Old 1/
4	Moose Cr.	Dug	1768	N20E	30	ABLA/VASC	Vc	1	Unknwon*	Good 1/
5	N Fk. Sun	Dug	1524	N360W	20	PSME/CARU/CARU	1	1	Unknown	Good 1/
6	Wright Cr.	Unknown	2073	N80E	40	ABLA/PIAL/VASC	25	1	212	Unknown 2/
7	Blackleaf Cr.	Unknown	1768	N5E	50	ABLA/ARCO	21A	1	509	Unknown 2/
8	Muddy Cr.	Dug	1670	S200W	40	PSME/JUHO	-	1	509	Good 1/
9	Teton River	Dug	1390	N90E	5	POTRE/SYMPHO	-	1	523	Good 1/
10	N Fk. Deep Cr.	Unknown	1890	S260W	60	Scree	-	1	517	Unknown 2/
11	Teton River	Dug	1368	N90E	1	POTRE/SALIX	-	1	523	Unknown 1/
12	Crab Butte	Unknown	1707	N350W	70	Scree	-	1	506	Unknown 2/
13	Massey Cr.	Cave	2267	N320W	60	Scree	VI	1	515	Unknown 2/
14	Ear Mtn.	Dug	1646	N90E	30	AGSP/FEID	-	0	-	Good

*Subadult male killed by hunter.
1 - Ground inspection of den was conducted
2 - Located from airplane.

Table 47. Dates of movements to dens and final entry of dens for black bears, 1981 - 1983.

Bear No.	Sex	Age	Year	Movement to Den Site	Approximate Den Entry	Reproductive Status
509	F	10.5	1981	Oct. 13	Oct. 13-16	Pregnant
212	M	6.5	1981	Oct. 22	Oct. 28	-
509	F	11.5	1982	Nov. 4	Nov. 8-18	Cubs present
523	F	3.5	1982	Oct. 25	Nov. 2	Pregnant
517	M	5.5	1982	Nov. 8	Nov. 8-18	-
523	F	7.5	1983	Oct. 28	Nov. 5-9	No cubs
506	M	4.5	1983	Nov. 5	Nov. 9-27	-
515	M	4.5	1983	Oct. 5	Nov. 9-27	-

Table 48. Dates of den emergence and movement from den sites, 1982-84.

Bear No.	Sex	Age	Year	Approximate Den Emergence	Movement from Den Site	Reproductive Status
509	F	11.5	1982	Apr. 23	May 1	Cubs present
212	M	7.5	1982	Apr. 2-9	Apr. 10	-
509	F	12.5	1983	Apr. 1-6	Apr. 7	Yearlings present
523	F	4.5	1983	Mar. 10-26	Mar. 26	No cubs
517	M	6.5	1983	Apr. 5	Apr. 18	-
523	F	5.5	1984	Apr. 1-3	Apr. 4	Cubs present
506	M	5.5	1984	May 1-5	Apr. 1-4	-
515	M	5.5	1984	March 26-28	May 5-8	-

Black Bear Habitat Use

This phase of black bear data was not completed at the time of this report. Black bear habitat use was previously summarized (Aune et al. 1983 and 1984). Work will continue on this subject for inclusion in the final project report.

Population Data, 1976-1986

During 1976-1986 at total of 69 and 70 black bears were captured and marked north and south of the Sun River, respectively (Appendix D). A grand total of 139 bears were marked, for an average of 12.6 new bears captured each year. Table 51 presents the number of black bears trapped, recaptured, and hunter killed during 1976-1986 for the north and south study areas.

Of 139 black bears captured, 102 (73%) were males and 37 (27%) were females. 74 (53%) were subadults, 55 (40%) were adults, 8 (6%) were yearlings and 2 (1%) were cubs. Sex and age ratios of captured bears were only slightly different between the north and south study areas (Table 51) (Appendix E). The mean age of black bears captured on the East Front was 5.5 years.

Table 49. Analysis results from 274 black bear scats from 1981-84.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
0009	Pinus albicaulis	3	11	4.01	928.00	3.39	84.36	.14	.85
0209	Pinus	3	11	.36	100.00	.36	100.00	.00	.01
	Total Trees		12	4.38	1028.00	3.75	85.67	.16	.46

1004	Arctostaphylos	0	1	.36	20.00	.07	20.00	.00	.00
1004	Arctostaphylos	1	3	1.09	29.00	.11	9.67	.00	.01
1004	Arctostaphylos	3	11	4.01	738.00	2.69	67.09	.11	.67
1004	Arctostaphylos	7	1	.36	100.00	.36	100.00	.00	.01
	Sub Total		16	5.84	887.00	3.24	55.44	.19	1.35

1035	Rosa	3	2	.73	16.00	.06	8.00	.00	.00
1105	Amelanchier alnifolia	3	7	2.55	660.00	2.41	94.29	.06	.38
1105	Amelanchier alnifolia	6	1	.36	100.00	.36	100.00	.00	.01
	Sub Total		8	2.92	760.00	2.77	95.00	.08	.58

1124	Prunus virginiana	3	6	2.19	455.00	1.66	75.83	.04	.23
1139	Shepherdia canadensis	3	8	2.92	116.00	.42	14.50	.01	.08
1139	Shepherdia canadensis	6	16	5.84	1190.00	4.34	74.38	.25	1.58
	Sub Total		24	8.76	1306.00	4.77	54.42	.42	2.99

1201	Arctostaphylos uva-ursi	3	4	1.46	135.00	.49	33.75	.01	.04
1201	Arctostaphylos uva-ursi	6	10	3.65	655.00	2.39	65.50	.09	.54
1201	Arctostaphylos uva-ursi	7	1	.36	30.00	.11	30.00	.00	.00
	Sub Total		15	5.47	820.00	2.99	54.67	.16	1.17

	Total Shrubs		68	24.82	4244.00	15.49	62.41	3.84	10.72

2006	Equisetum	1	29	10.58	1539.00	5.62	53.07	.59	3.70
2006	Equisetum	4	1	.36	10.00	.04	10.00	.00	.00
2006	Equisetum	7	1	.36	85.00	.31	85.00	.00	.01
	Sub Total		31	11.31	1634.00	5.96	52.71	.67	4.83

2008	Lycopodium	1	1	.36	20.00	.07	20.00	.00	.00
	Total Sporophytes		32	11.68	1654.00	6.04	51.69	.70	1.97

Table 49. Analysis results from 274 black bear scats from 1981-84.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
3000	Graminoid	1	2	.73	30.00	.11	15.00	.00	.00
3004	Avena	3	1	.36	10.00	.04	10.00	.00	.00
3005	Bromus	14	2	.73	30.00	.11	15.00	.00	.00
3007	Carex	1	1	.36	15.00	.05	15.00	.00	.00
3007	Carex	14	1	.36	5.00	.02	5.00	.00	.00
	Sub Total		2	.73	20.00	.07	10.00	.00	.00
3013	Festuca	14	1	.36	10.00	.04	10.00	.00	.00
3023	Poa	1	6	2.19	300.00	1.09	50.00	.02	.15
3023	Poa	14	1	.36	25.00	.09	25.00	.00	.00
	Sub Total		7	2.55	325.00	1.19	46.43	.03	.22
3102	Grass/Sedge	1	118	43.07	5924.00	21.62	50.20	9.31	57.96
3102	Grass/Sedge	7	9	3.28	480.00	1.75	53.33	.06	.36
	Sub Total		127	46.35	6404.00	23.37	50.43	10.83	77.58
3442	Avena sativa	3	2	.73	170.00	.62	85.00	.00	.03
	Total graminoids		142	51.82	6999.00	25.54	49.29	13.24	36.91
4000	Forb	0	1	.36	10.00	.04	10.00	.00	.00
4000	Forb	1	19	6.93	494.00	1.80	26.00	.13	.78
	Sub Total		20	7.30	504.00	1.84	25.20	.13	.96
4011	Angelica	0	1	.36	55.00	.20	55.00	.00	.00
4011	Angelica	1	3	1.09	145.00	.53	48.33	.01	.04
	Sub Total		4	1.46	200.00	.73	50.00	.01	.08
4041	Cirsium	1	2	.73	160.00	.58	80.00	.00	.03
4084	Hedysarum	1	1	.36	5.00	.02	5.00	.00	.00
4100	Lathyrus	1	27	9.85	1159.00	4.23	42.93	.42	2.59
4102	Ligusticum	1	1	.36	15.00	.05	15.00	.00	.00
4131	Osmorhiza	1	13	4.74	780.00	2.85	60.00	.14	.84

Table 49. Analysis results from 274 black bear scats from 1981-84.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
4171	Taraxacum	1	3	1.09	55.00	.20	18.33	.00	.01
4171	Taraxacum	6	1	.36	95.00	.35	95.00	.00	.01
4171	Taraxacum	7	1	.36	100.00	.36	100.00	.00	.01
4171	Taraxacum	14	24	8.76	938.00	3.42	39.08	.30	1.87
4171	Taraxacum	15	1	.36	60.00	.22	60.00	.00	.00
4171	Taraxacum	17	9	3.28	520.00	1.90	57.78	.06	.39
4171	Taraxacum	19	2	.73	105.00	.38	52.50	.00	.02
	Sub Total		41	14.96	1873.00	6.84	45.68	1.02	7.33
4177	Tragopogon	3	2	.73	5.00	.02	2.50	.00	.00
4177	Tragopogon	14	1	.36	75.00	.27	75.00	.00	.01
4177	Tragopogon	15	1	.36	60.00	.22	60.00	.00	.00
4177	Tragopogon	17	2	.73	180.00	.66	90.00	.00	.03
4177	Tragopogon	19	1	.36	15.00	.05	15.00	.00	.00
	Sub Total		7	2.55	335.00	1.22	47.86	.03	.22
4180	Trifolium	1	4	1.46	80.00	.29	20.00	.00	.03
4353	Umbelliferae-Apiaceae	1	7	2.55	375.00	1.37	53.57	.03	.22
4356	Lilicaceae	1	1	.36	40.00	.15	40.00	.00	.00
4481	Heracleum lanatum	1	10	3.65	780.00	2.85	78.00	.10	.65
4482	Heuchera cylindrica	1	1	.36	5.00	.02	5.00	.00	.00
4488	Lathyrus ochroleucus	14	1	.36	40.00	.15	40.00	.00	.00
4991	Taraxacum officinale	6	2	.73	160.00	.58	80.00	.00	.03
4991	Taraxacum officinale	14	11	4.01	445.00	1.62	40.45	.07	.41
4991	Taraxacum officinale	17	2	.73	104.00	.38	52.00	.00	.02
	Sub Total		15	5.47	709.00	2.59	47.27	.14	1.01
	Total Forbs		109	39.78	7060.00	25.77	64.77	10.25	28.58
6002	Large Mammal-Unident	22	2	.73	11.00	.04	5.50	.00	.00
6002	Large Mammal-Unident	23	1	.36	5.00	.02	5.00	.00	.00
6002	Large Mammal-Unident	27	1	.36	75.00	.27	75.00	.00	.01
6002	Large Mammal-Unident	30	1	.36	80.00	.29	80.00	.00	.01
	Sub Total		5	1.82	171.00	.62	34.20	.01	.08

8072/2

Table 49. Analysis results from 274 black bear scats from 1981-84.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
6003	Elk	22	1	.36	40.00	.15	40.00	.00	.00
6005	Sheep-Domestic	30	2	.73	40.00	.15	20.00	.00	.01
6008	Microtus	33	1	.36	70.00	.26	70.00	.00	.01
6009	Deer	22	6	2.19	91.00	.33	15.17	.01	.05
6009	Deer	26	1	.36	50.00	.18	50.00	.00	.00
6009	Deer	30	9	3.28	311.00	1.14	34.56	.04	.23
	Sub Total		16	5.84	452.00	1.65	28.25	.10	.69
6014	Domestic Cattle	20	1	.36	10.00	.04	10.00	.00	.00
6014	Domestic Cattle	22	4	1.46	115.00	.42	28.75	.01	.04
6014	Domestic Cattle	30	6	2.19	340.00	1.24	56.67	.03	.17
6014	Domestic Cattle	37	2	.73	110.00	.40	55.00	.00	.02
	Sub Total		13	4.74	575.00	2.10	44.23	.10	.71
6020	Lagomorph	30	1	.36	90.00	.33	90.00	.00	.01
6020	Lagomorph	31	1	.36	100.00	.36	100.00	.00	.01
	Sub Total		2	.73	190.00	.69	95.00	.01	.04
6022	Small Mammal-Unid	30	2	.73	100.00	.36	50.00	.00	.02
6023	Spermophilus-citellus	30	4	1.46	140.00	.51	35.00	.01	.05
6023	Spermophilus-citellus	31	1	.36	9.00	.03	9.00	.00	.00
6023	Spermophilus-citellus	33	1	.36	15.00	.05	15.00	.00	.00
	Sub Total		6	2.19	164.00	.60	27.33	.01	.09
6026	Microtinae	30	1	.36	30.00	.11	30.00	.00	.00
	Total Mammals		47	17.15	1832.00	6.69	38.98	1.15	3.20
6302	Ant	0	105	38.32	1725.00	6.30	16.43	2.41	15.02
6304	Bee	0	1	.36	100.00	.36	100.00	.00	.01
6307	Moths	0	6	2.19	225.00	.82	37.50	.02	.11
6308	Coleoptera	0	2	.73	15.00	.05	7.50	.00	.00
	Total Insects		113	41.24	2065.00	7.54	18.27	3.11	8.67

Table 49. Analysis results from 274 black bear scats from 1981-84.

Item NMBR	Item Name	Item Part	Freq. No.	Freq. %	Tot Vol.	Vol %	% Comp	Impt Value	Impt Value %
6601	Unidentified Bird	0	1	.36	5.00	.02	5.00	.00	.00
6601	Unidentified Bird	41	3	1.09	7.00	.03	2.33	.00	.00
	Sub Total		4	1.46	12.00	.04	3.00	.00	.00
	Total Birds		4	1.46	12.00	.04	3.00	.00	.00
6702	Plastic	0	1	.36	20.00	.07	20.00	.00	.00
	Total Garbage		1	.36	20.00	.07	20.00	.00	.00
6801	Debris	0	65	23.72	1526.00	5.57	23.48	1.32	8.22
6802	Wood	0	13	4.74	124.00	.45	9.54	.02	.13
6804	T-Bait	0	1	.36	100.00	.36	100.00	.00	.01
6804	T-Bait	22	2	.73	10.00	.04	5.00	.00	.00
6804	T-Bait	30	1	.36	20.00	.07	20.00	.00	.00
	Sub Total		4	1.46	130.00	.47	32.50	.01	.05
6806	Dirt	0	28	10.22	499.00	1.82	17.82	.19	1.16
6807	Rocks	0	10	3.65	82.00	.30	8.20	.01	.07
6808	Needles	0	3	1.09	125.00	.46	41.67	.00	.03
	Total Other		103	37.59	2486.00	9.07	24.14	3.41	9.51

8072/2

Table 50. Percent frequency and percent volume of bear food taxon for each month and rank of each.

	April		May		June		July		Aug.		Sept.		Oct.		Nov.		Total		Rank	
	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.
	N=3		N=59		N=67		N=49		N=41		N=37		N=15		N=3		N=274			
Mammals	--	--	25.4	10.9	14.9	4.0	16.3	6.1	14.6	7.2	13.5	6.2	20.0	6.6	--	--	17.2	6.7	6	6
Insect	--	--	35.6	5.5	52.2	4.6	46.9	7.9	41.5	10.8	29.7	12.4	40.0	9.5	--	--	41.2	7.5	2	5
Birds	--	--	--	--	1.5	.01	2.0	0.1	2.4	0.1	--	--	6.7	0.1	--	--	1.46	.04	9	9
Pine Nuts	--	--	--	--	1.5	1.5	2.0	.08	2.4	2.4	10.8	10.8	33.3	28.3	--	--	4.4	3.8	8	8
Sporophytes	33.3	13.3	10.2	4.5	19.4	9.0	16.3	9.8	7.3	5.5	2.7	1.1	--	--	--	--	11.7	6.0	7	7
Forbs	--	--	25.4	12.4	62.7	39.1	63.3	44.4	26.8	17.1	16.2	13.2	26.7	22.7	--	--	39.8	25.8	3	2
Graminoids	100.0	86.7	76.3	52.3	59.7	22.8	40.8	9.5	41.5	19.9	29.7	14.5	40.0	20.7	--	--	51.8	25.5	1	1
Fruit	--	--	15.3	6.1	19.4	10.5	24.5	12.0	34.2	25.7	43.2	32.0	6.7	4.0	100.0	98.3	24.8	15.5	5	3
Debris	--	--	42.4	8.2	7.5	1.8	40.8	10.2	41.5	11.3	43.2	9.7	33.3	8.1	33.3	1.7	37.6	9.1	4	4

Table 51. Black bears captured, and marked bears killed by hunters on the Rocky Mountain East Front, 1976-1986.

	Total No. of Bears Captured							No. of Bears Recaptured							No. Marked Bears Killed by Hunters							No. Marked Bears Recaptured then Killed by Hunters						
	Total	M	F	AD[1]	SA[2]	YR	C	Subtotal	M	F	AD	SA	YR	C	Subtotal	M	F	AD	SA	YR	C	Subtotal	M	F	AD	SA	YR	C
TOTAL = North	69	49	20	27	40	0	2	23	17	6	16	7	0	0	18	16	2	15	3	0	0	6	6	0	4	2	0	0
South	70	53	17	27	35	8	0	21	18	3	14	7	0	0	24	17	7	12	12	0	0	6	6	0	5	1	0	0
TOTAL NO.	139	102	37	54	75	8	2	44	35	9	30	14	0	0	42	33	9	27	15	0	0	12	12	0	9	3	0	0
Average No./Year	12.6	9.3	3.4	4.9	6.8	0.7	0.2	4.4	3.2	0.8	2.7	1.3	0	0	3.8	3.3	0.8	2.0	1.4	0.0	0.0	1.1	1.1	0.0	0.8	0.3	0.0	0.0

[1] Adults: bears 5.5 years of age and older.
[2] Subadults: bears greater than 2.5 years of age and less than 5.5 years of age.

8072/2

Between 1976 and 1986, 44 bears (32%) were recaptured at least once (Table 50), (Appendix D), for an average of 4.0 bears recaptured each year. Mean time between recaptures was approximately 12.6 months (Appendix D). Of the 102 males and 37 females captured during the study, 35 (34%) and 9 (24%) were recaptured, respectively. Of the bears recaptured, 80% were males and 20% were females; 66% were adults, 32% were subadults, and 2% were yearlings (Table 51).

For the period 1976-1986 a total of 42 (30%) of the 139 marked black bears were killed by hunters, for an average of 3.8 marked bears killed each year (Table 50), (Appendices D and E). Of the 102 males and 37 females initially captured and marked, 33 (32%) and 9 (24%) were killed by hunters, respectively. Of these, 64% were adults and 36% were subadults. No marked yearlings were killed by hunters (Table 51). The mean age of marked black bears killed by hunters on the East Front was 6.3 years.

Twelve (9%) of the marked bears were recaptured and later killed by hunters, for an average of 1 bear each year. All were males (Table 51). Correspondingly, of the 44 bears that were recaptured, 25% were later killed by hunters. Of the bears falling into this category 9 (75%) were adults and 3 (25%) were subadults.

Due to the short duration of the radio-monitoring program little data on reproductive rates was accumulated from collared bears. Only 3 (8%) of the females captured were known to have cubs of the year with them at the time. Table 52 was developed from creditable reports of sightings of black bears. During 1980-1986, 311 black bear sightings were reported, for an average of 47 sightings each year. Eighty-one percent of the sightings were of black bears in the area north of the Sun River. Thirty-nine (12.5%) of all sightings were of females accompanied by cubs of the year. The average litter size of female black bears observed along the East Front was 1.79 cubs per female.

Black Bear Density Estimates

Black bear density estimates were developed for two areas along the East Front. The estimate for the first area, the Beaver Creek-Willow Creek area, south of the Sun River, was derived from capture-recapture data for 1983-84. The minimum population estimate (N=21) for this area was the total number of individual black bears captured during 1983 and 1984. The total population estimate was derived using the Lincoln Index. This method requires four assumptions: (1) no loss of marks; (2) no recruitment (births or immigrations); (3) no difference in mortality of the marked and unmarked individuals; (4) catchability is the same for marked and unmarked individuals. For the sample period we used, assumption (1) was probably true. Although ear tags may be lost within one year, the lip tatoos are not likely to be lost. Assumptions (2, 3, and 4) may or may not be true and could bias the results. However given the lack of any substantive effort to determine population size or density of black bears in this region we chose to use the index for the purpose of deriving a conservative population estimate for the analysis area.

The number of bears caught and marked in 1983 was 10 (Table 53). The total number of bears caught in 1984 was 13 of which 2 were previously marked in 1983

Table 52. Female black bears with cubs sighted on the Rocky Mountain East Front, north and south of the Sun River, 1980-1986.

Year	No. Bear Sightings			% Females W. Cubs Sighted			Females			Cubs			Cubs/Female		
	North	South	Total	North	South	Total	North	South	Total	North	South	Total	North	South	Total
1980	20	4	24	30.0	50.0	33.3	6	2	8	9	3	12	1.50	1.50	1.50
1981	50	1	51	08.0	00.0	7.8	4	0	4	5	0	5	1.25	0.00	1.25
1982	42	3	45	16.6	33.3	17.8	7	1	8	15	2	17	2.14	2.00	2.13
1983	50	21	71	08.0	00.0	5.6	4	0	4	6	0	6	1.50	0.00	1.50
1984	53	14	67	09.4	21.4	11.9	5	3	8	8	8	16	1.60	2.67	2.00
1985	16	5	21	06.3	00.0	4.8	1	0	1	2	0	2	2.00	0.00	2.00
1986	20	12	32	25.0	8.3	18.8	5	1	6	9	3	12	1.80	3.00	2.00
Total	251	60	311	----	----	----	32	7	39	54	16	70	----	----	----
Average	35.9	8.6	44.4	12.7	11.7	12.5	4.6	1.0	5.6	7.7	2.3	10.0	1.69	2.29	1.79

(Table 53). Using the Lincoln Index:

$$N = \frac{Mn}{m};$$

where N=total population size
M=total number of individuals originally marked
n=total number of individuals caught at a subsequent time
m=total previously marked individuals caught at a subsequent time;

$$N = \frac{10(13)}{2} = 65 \text{ black bears}$$

The estimated area used by these bears was determined by drawing a circle, with a radius of ½ the average standard home range diameter, around each capture site within the trap circuit and determining the area enclosed by these circles using a planimeter. The average standard home range diameter was derived from the standard home range diameter for male and female black bears radioinstrumented in the Deep Creek-Birck Creek study area, weighted by the number of males and females caught during the sample period in the Beaver Creek-Willow Creek area. The resulting area was 728 km^2 (281 mi^2) (Fig. 46). The minimum density estimate for this area was 1 bear/34.7 km^2 (13.4 mi^2), and the total density estimate was 1 bear/11.2 km^2 (4.3 mi^2).

The density estimate for the Deep Creek-Birch Creek study area was derived from the composite home range of radioinstrumented black bears, modified to exclude habitat unsuitable to black bears along the eastern edge of black bear range, (Fig. 47) to determine the area, and the number of radioinstrumented and unmarked but identifiable observed bears for the total population estimate (Aune et al. 1984). The area of the composite home range was 1101 km^2 (425 mi^2) and the total population estimate was 39 bears for a density of 1 bear/28.2 km^2 (10.9 mi^2). Without excluding unsuitable habitat the composite home range was 1136 km^2 (439 mi^2).

After deriving density estimates for the Beaver-Willow Creek and Deep Creek-Birch Creek area we calculated a population estimate for the entire East Front by applying the density for the Beaver-Willow Creek area to the BMUs (North Fork Sun River, South Fork Sun River, Dearborn-Elk Creek; total area 2202 km^2 (850 mi^2); N=198 bears) (Figures 32, 33 and 34) with habitat similar to that area, and applying the density for the Deep Creek-Birch Creek area to the BMUs (Badger-Two Medicine, Teton-Birch Creek, Teton-Sun River; total area=3549 km^2 (984 mi^2), N=126 bears) (Figures 29, 30 and 31) with habitat similar to that area. This method yielded a total population estimate of 324 black bears for the East Front.

It is most likely that the black bear density in the northern regions is somewhat higher than estimated. The total area of black bear habitat used in our analysis is probably over estimated because it is based on area calculations from grizzly bear BMUs. Data from radioed black bears indicated they probably do not extend easterly as far as grizzly bears and are more closely tied to timbered habitats along the front. Reducing the size of the total area would reduce the population estimate. At this time no other population estimate is

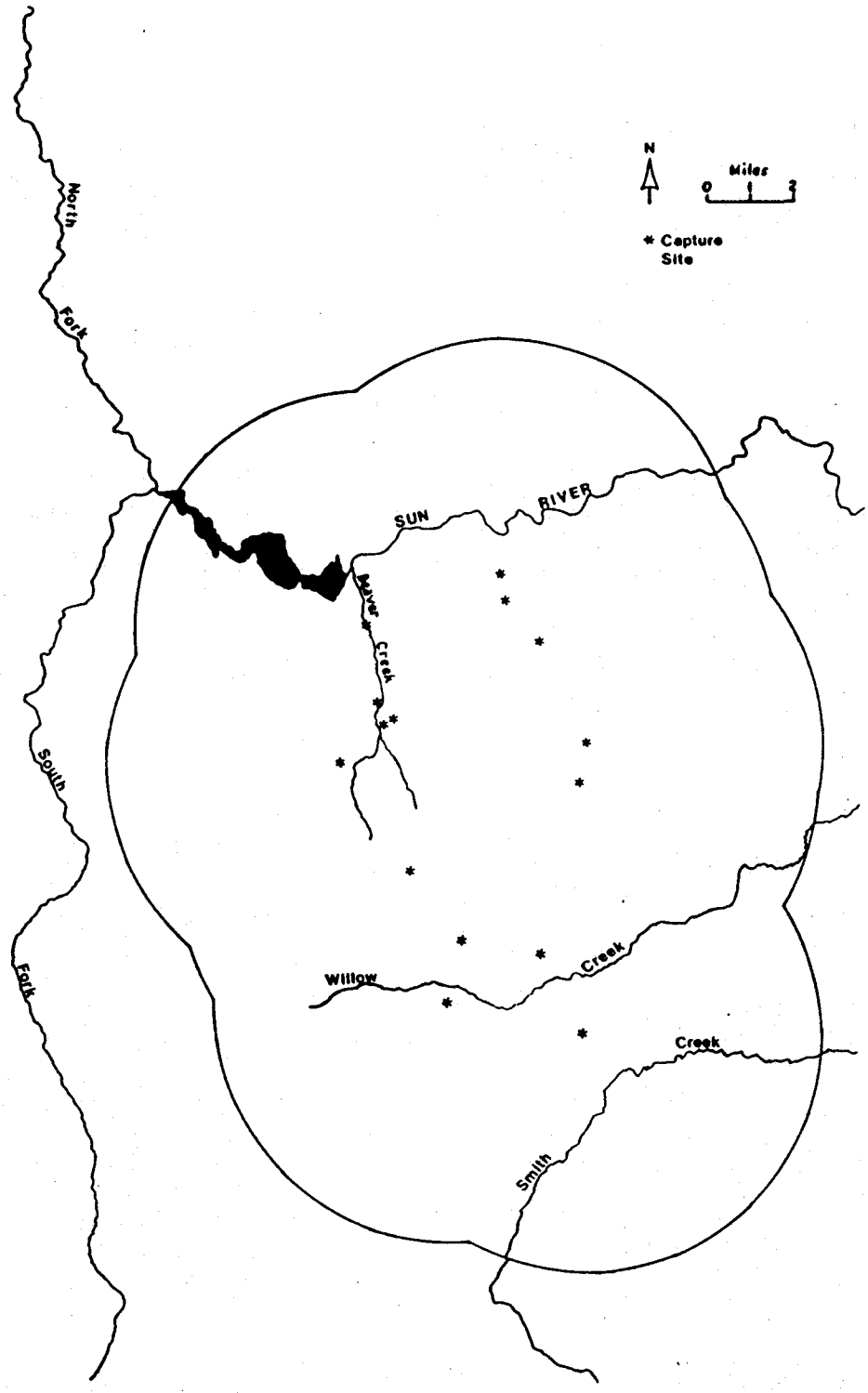

Figure 46. Area used for Beaver Creek-Willow Creek density estimate.

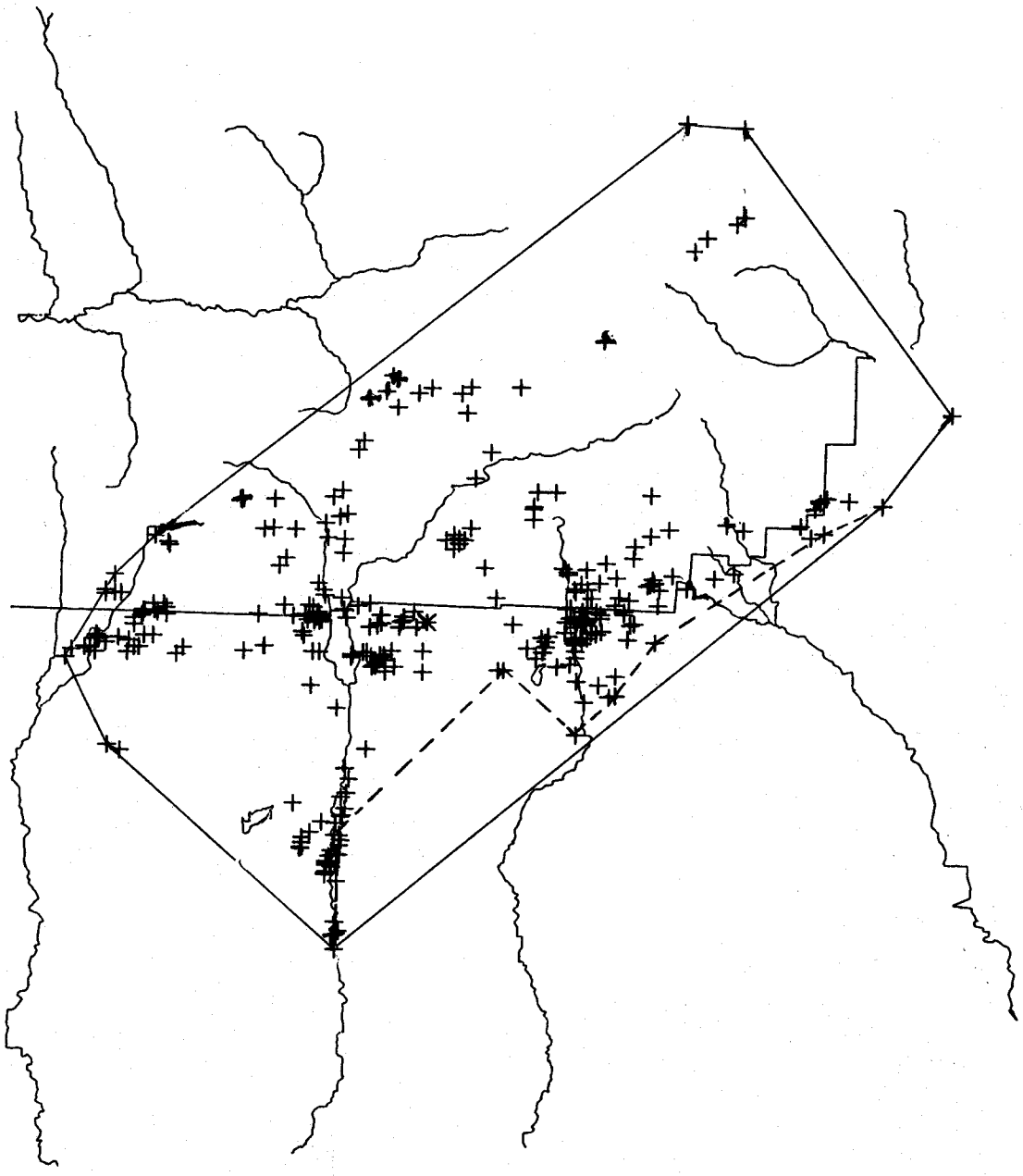

Figure 47. Composite and modified composite home range of black bears along the Rocky Mountain East Front, 1981-84.

Table 53. Black bears captured in the Beaver Creek-Willow Creek sample area, 1983-1984.

Date of Capture	No.	Sex	Age (1984)	Location	Ear Tag (Type)	Color	Fate
6/11/83	532	M	4.5	Willow Cr.	Blue (rototag)	Black	Hunter killed 5/21/84
6/13/83	534	M	4.5	Sun River Game Range	Blue (rototag)	Black	Recaptured 6/27/83, 5/11/84
6/16/83	478	M	4.5	Sun River Game Range	Green (rototag)	Black	Hunter kill 5/21/86
6/17/83	479	F	2.5	Beaver Cr.	Green (rototag)	Black	Unknown
6/19/83	513	M	4.5	Sun River Game Range	Red (rototag)	Brown	Recaptured 5/17/84
6/21/83	477	F	11.5	Willow Cr.	Green (rototag)	Brown	Recaptured 5/21/86
6/25/83	491	F	3.5	Beaver Cr.	Green (rototag)	Black	Unknown
6/25/83	492	M	6.5	Beaver Cr.	Green (rototag)	Brown	Hunter kill 5/27/85
6/27/83	476	M	4.5	Willow Cr.	Green (rototag)	Black	Unknown
6/27/83	494	F	1.5	Rose Cr.	Green (rototag)	Black	Unknown
5/2/84	327	M	10.5	Willow cr.	Green (rototag)	Brown	Recaptured 5/23/84, 6/27/86
5/5/84	352	M	7.5	Beaver Cr.	Green (rototag)	Black	Recaptured 5/12/84
5/8/84	353	M	2.5	Beaver Cr.	Green (rototag)	Cinnamon	Unknown
5/10/84	364	F	2.5	Sun River Game Range	Green (rototag)	Brown	Unknown
5/10/84	339	M	9.5	Ford Cr.	Green (rototag)	Brown	Unknown
5/10/84	344	M	1.5	Beaver Cr.	Green (rototag)	Blonde	Unknown
5/13/84	375	M	14.5	Sun River Game Range	Green (rototag)	Black	Unknown
5/14/84	331	F	5.5	Willow Cr.	Green (rototag)	Brown	Recaptured 5/18/84, 5/16/86
5/22/84	380	F	20.5	Shed Cr.	Green (rototag)	Cinnamon	Hunter kill 6/1/85
5/22/84	387	M	1.5	Shed Cr.	Green (rototag)	Black	Unknown
5/23/84	389	F	2.5	Beaver Cr.	Green (rototag)	Black	Unknown

[1] - This bear was not excluded from the analysis because it was available for capture for the majority of the capture period in 1984.

8072/2

available for the Rocky Mountain Front. Further work is needed to validate these estimates.

Black Bear Harvest Rate

In 1986, 61 black bears were harvested along the Front by hunters as determined by the mandatory hunter tooth check established in 1985. (Table 54). Considering the total population estimate the harvest rate was 19% for 1986. Data from 1985 indicated a harvest of 34 black bears via the tooth check information (Table 55), for an estimated harvest rate of 11%. The average harvest rate for the last two years is 15%.

Recommended black bear harvest rates range between 10-20% in North America (Erickson 1965, Poelker and Hartwell 1973, Waddell and brown 1984, Kohn 1982). Kasworm (1986) recommends a harvest rate of 10% for northwestern Montana. Considering that the density of bears in his study area is higher and the population is probably more productive than in the East Front, a higher level of harvest would not be suitable for the drier less productive black bear habitats of central Montana.

An annual harvest of 61 bears at a harvest rate of 10% requires a population of 610 black bears considerably more than our current estimate of 324 black bears. A population of 610 black bears along the East Front would translate into bear densities of 1 bear/3.0 sq. mi. a density more common to areas with richer coniferous forest and better quality habitat.

Harvest rates calculated for the East Front may be underestimated due to noncompliance with the mandatory tooth check regulation. It is likely that actual harvest thus presented are actually higher. Jerry Brown (pers. comm.) indicated that compliance with the reporting regulation in Montana's management region 1 was 70% in 1985 and that compliance in 1986 was improved but still below 100%. A compliance rate of 70% in 1985 would correct our 1985 harvest to 49 black bears and our 1985 harvest rate to 15% raising our two year harvest average to 17%. While a harvest of 15-19% might be acceptable as a one year perturbation, a long term harvest rate of this level could reduce the population along the East Front and will certainly affect the age structure and quantity of trophy black bears along the East Front. This level of harvest coupled with the poor bear food years of 1985 and 1986 with subsequent higher natural mortality and lower production may quickly impact the population. Recent studies suggested that the nutritional base affects cub production and survival (Jonkel and Cowen 1971, Rogers 1976, Beecham 1980, Alt 1982, Lecount 1982, and Hugie 1982). The absence of annual production data and harvest trends from the East Front to measure the impact of increased harvest rates and drought conditions creates further concern.

Data on the age and sex composition of the harvest on the East Front are also of concern. In 1985 the median age of harvested males, females and both sexes combined was 3.5 years. In 1986 the median age for each of these sex classes was 4.5 years. The sex composition of the harvest was 75% male, 25% female in 1985, and 71% male, 29% female in 1986. In 1985 the subadult: adult ratio of the harvest was 63:37 and in 1986 it was 61:39. Kasworm (1986) reported that the median age decreases and the subadult proportion of the harvest increases as hunting pressure increases on black bears. Similar findings have been reported

Table 54. Black bear harvest from the Rocky Mountain East Front, 1986.

Date	Hunting District	Location	Sex	Age	Color	Bear No.
4/17	424	Ford Cr.	M	10.5	Brown	-
4/26	442	S. Fk. Teton R.	M	4.5	Brown	-
5/6	424	Elk Cr.	M	5.5	Brown	-
5/16	422	Green Cr.	F	15.5	Black	-
5/16	424	Smith Cr.	F	4.5	Black	405
5/17	425	Willow Cr.	F	7.5	Brown	-
5/18	424	Beaver-Willow	M	2.5	Black	-
5/18	425	Burdoff	F	4.5	Brown	-
5/20	442	Green Timber Cr.	M	9.5	Black	352
5/21	424	Elk Cr.	M	6.5	Black	478
5/22	422	Elk Cr.	M	4.5	Brown	353
5/24	442	Lynx Cr.	M	10.5	Black	-
5/25	424	Elk Cr.	M	9.5	Brown	354
5/26	422	Sawmill Cr.	M	4.5	Black	495
6/3	442	Rierdon Gulch	F	4.5	Black	-
6/12	424	Beaver Cr.	M	1.5	Black	-
6/14	442	N. Fk. Sun R.	M	2.5	Black	-
7/5	442	Big George	F	16.5	Brown	-
7/20	442	Big George	M	4.5	Black	-
7/26	442	-	M	2.5	Black	-
8/2	424	Fairview Cr.	F	7.5	Black	417
8/10	441	Birch Cr.	M	1.5	Black	-
8/22	441	Jones Cr.	F	2.5	Black	-
9/1	424	Fairview Cr.	M	1.5	Black	-
9/2	406	Birch Cr.	M	2.5	Black	-
9/3	406	Teton R.	M	2.5	Black	-
9/8	406	Teton R.	F	9.5	Black	-
9/13	424	S. Fk. Sun R.	M	4.5	Brown	-
9/13	441	E. Fk. Teton R.	M	4.5	Brown	-
9/20	425	Rose Cr.	M	5.5	-	-
9/20	425	N. Fk. Barrs Cr.	M	4.5	Brown	-
9/20	442	Sawmill Flats	F	1.5	Black	-
9/21	442	Beaver Cr.	M	10.5	Balck	427
9/25	422	Blubber Cr.	M	15.5	Black	202
9/27	422	Elk Cr.	F	6.5	Blond	345
9/28	422	Cunniff Basin	M	4.5	Brown	337
9/28	441	Dupuyer Cr.	F	8.5	Black	531
10/1	442	Ear Mtn.	M	7.5	Brown	-
10/3	450	Teton R.	M	7.5	Black	-
10/4	441	S. Fk. Dupuyer Cr.	M	2.5	Brown	-
10/4	404	Beartooth	F	13.5	Black	105
10/5	442	Teton R.	F	8.5	Brown	-
10/5	442	Deep Cr.	M	5.5	Black	-
10/6	441	Scoffin Cr.	M	2.5	Black	-

Table 54. Black bear harvest from the Rocky Mountain East Front, 1986.

Date	Hunting District	Location	Sex	Age	Color	Bear No.
10/6	442	Deep Cr.	F	1.5	Brown	-
10/7	442	Deep Cr.	M	4.5	Black	-
10/7	442	Ear Mtn.	M	2.5	Brown	-
10/8	415	East Glacier	M	2.5	Black	458
10/11	422	Green Cr.	M	4.5	Brown	-
10/11	450	-	M	2.5	Black	-
10/11	450	Teton R.	F	2.5	Black	-
10/21	441	Crazy Cr.	M	4.5	Black	-
10/22	422	Elk Cr.	M	2.5	Black	-
11/2	442	Arsenic Cr.	F	3.5	Black	-
11/23	441	Dupuyer Cr.	M	3.5	Brown	-
6/8	415	Two Medicine R.	M	12.5	Black	-
10/11	442	Little Willow Cr.	M	2.5	Black	-
9/26	424	Wood Lake	M	4.5	Black	-
4/17	441	Cow Cr.	M	6.5	Brown	-
4/20	441	Teton	M	7.5	Black	-
5/6	415	S. Fk. Two Medicine R.	F	4.5	Brown	-

8072/2

Table 55. Black bear harvest from the Rocky Mountain East Front, 1985.

Date	Hunting District	Location	Sex	Age	Color	Bear No.
5/6	424	Smith Creek	M	7.5	Black	-
5/8	424	Ford Creek	M	3.5	Brown	-
5/11	424	Smith Creek	M	15.5	Brown	-
5/15	422	Elk-Blubber Cr.	M	5.5	Black	535
5/15	441	Scoffin Cr.	M	6.5	Black	-
5/16	422	Blubber Cr.	M	?	Black	-
5/18	442	Rierdon Gulch	M	7.5	Black	517
5/20	442	Rierdon Gulch	M	6.5	Black	-
5/23	424	Ford Creek	F	15.5	Black	-
5/25	428	Lange Creek	M	2.5	Black	-
5/25	442	Arsenic Cr.	M	1.5	Brown	-
5/26	424	Bear Gulch	M	7.5	Brown	-
5/27	424	Fairview Creek	M	7.5	Brown	492
5/28	442	Hannon Gulch	M	1.5	Black	-
6/1	425	Sun River Game Range	F	21.5	Cinnamon	380
6/2	442	S. Fk. Teton River	M	3.5	Black	-
6/4	442	Waldron Creek	M	2.5	Brown	-
6/6	442	Ear Mountain	M	2.5	Black	-
6/6	442	Ear Mountain	F	3.5	Brown	-
6/15	441	N. Fk. Teton River	F	2.5	Brown	-
6/15	442	N. Fk. Sun River	M	4.5	Brown	-
7/?	442	Moose Creek	M	3.5	Blonde	330
8/11	441	Jones Creek	M	6.5	Black	515
9/6	422	Falls Creek	M	3.5	Black	370
9/25	406	Teton River	M	3.5	Brown	-
9/25	442	Little Willow Cr.	M	?	Black	-
10/27	424	Lime Gulch	M	1.5	Brown	-
10/29	442	Stovepipe Cr.	F	12.5	Brown	-
10/29	422	Joslin Basin	F	2.5	Black	362
10/31	424	Smith Creek	F	1.5	Black	-
10/31	424	Willow Creek	M	1.5	Brown	-
11/3	422	Falls Creek	M	4.5	Black	-
11/5	442	Blacktail Creek	M	1.5	Brown	-
11/6	428	Bighead Creek	F	3.5	Black	400

8072/2

elsewhere in North America (Beecham (1980, Hugie 1982, Kohn 1982, Modafferi 1982, Woddell and Brown 1984). Although we do not have data from enough years for the East Front to make these comparisons, the median age and subadult proportion of the harvest are similar to those reported by Kasworm (1986) as being cause for concern.

Management guidelines for black bears in MDFWP Administrative Region 1 call for 1) median age of harvested females 1-2 years above age of first production, 2) female proportion of the total harvest should not exceed 40%, 3) subadult proportion of the total harvest should not exceed 50%, and 4) the harvest rate should be approximately 10%. Our data for the East Front indicates that the age at first reproduction is 5 years or greater, female proportion of the harvest is 28%, subadult proportion of the harvest is 61%, and the harvest rate is 15-19% over the past two years. These data show that the harvest on the East Front exceeded three of the four criterion. Actions should be initiated to bring these parameters within responsible management guidelines.

It is our recommendation that hunter harvest be reduced to 10% for the Rocky Mountain Front region. This could be accomplished by restricting season length, permit hunting, quotas, or redistribution of hunter pressure. Hunting harvest may be related to accessibility of an area by vehicle (Hugie 1982, Lecount 1982, and Manville 1983). Although data are not available for the front area specifically, observations seem to support that much of our harvest comes from drainages and areas accessible with vehicles (Table 56). These do not comprise whole hunting districts but most generally portions of districts. A significant portion of the black bear habitat is within remote wilderness areas. In these portions harvest rates are generally low. Some redistribution of hunting pressure is possible but it would not likely reduce hunting harvest appreciably. Harvest rates by hunting district could not be calculated. However, further work could produce some data by hunting district groups and further monitoring of harvest could provide hunting harvest trends. Mandatory tooth collection should be continued along the front because this may be the only data base from which to base management decisions.

Table 56. Black bear harvest by hunting district for the Rocky Mountain East Front, 1985 and 1986.

Year	Hunting District										
	404	406	415	422	424	425	428	441	442	450	Total
1985	0	1	0	5	9	1	2	3	13	0	34
1986	1	3	3	8	11	4	0	10	18	3	61
TOTAL	1	4	3	13	20	5	2	13	31	3	95

Some specific problem areas may exist on the Rocky Mountain Front. Heavy hunter pressure is being experienced in local areas such as Elk-Blubber Creek, Ear Mtn. WMA, and Jones Creek. These areas are popular to the sportsman and could be mortality sumps that are maintained only by their proximity to remote and wilderness areas. Hunting district 415 reports only 3 black bears harvested in two years. This is productive black bear habitat adjacent to the Blackfoot

Indian Reservation. Black bears harvested by the tribal members may not be reported to the Montana Dept. of Fish, Wildlife, and Parks. The absence of such information is likely to make season setting for this district difficult. Data from grizzly and black bear studies demonstrates the interdependence of foothill and front country to the interior mountains in providing a complete habitat for bears. This interdependence means that management of black bears in H.D. 415 is related to management of adjacent areas in the Blackfoot Reservation.

The most likely options to appreciably reduce harvest rate of black bears are restricting season length, permit hunting, or quotas. Season length adjustments are not likely to reduce recreation opportunity as much as the other two. A split season from April 15 to May 31 and Oct. 1 to Nov. 30 could result in a harvest rate of 9% if there is a direct correlation with bears killed and hunter effort over time (i.e. a reduction of 37 harvested bears based on data from Table 57). However it is likely that restrictions in season length will result in greater hunter effort during a shorter time frame rather than a reduction in the harvest. If season restrictions are imposed, monitoring of harvest rate should be initiated to evaluate whether this rate is affected.

Table 57. Monthly black bear harvest by hunting district for the Rocky Mountain East Front, 1985-1986.

Month	Hunting District										Total
	404	406	415	422	424	425	428	441	442	450	
April	0	0	0	0	1	0	0	2	1	0	4
May	0	0	1	5	11	2	1	1	6	0	27
June	0	0	1	0	1	1	0	1	7	0	11
July	0	0	0	0	0	0	0	0	4	0	4
August	0	0	0	0	1	0	0	3	0	0	4
Sept.	0	4	0	4	3	2	0	2	3	0	18
Oct.	1	0	1	3	3	0	0	3	8	3	22
Nov.	0	0	0	1	0	0	1	1	2	0	5
Total	1	4	3	13	20	5	2	13	31	3	95

It is unlikely that black bear management in Montana will remain simple. More sophisticated forms of data will be necessary to make management decisions. The absence of trend data on harvest rates, production data, and limited population data coupled with complex demands of the users of this wildlife resource can only increase the potential for problems with management in the near future.

Without adequate biological information bears, cats and other large predatory/scavenger wildlife species are susceptible to overharvest (Beecham 1983, Bunnell and Tait 1981, Hemker 1984 and Harris 1984). These species require different management philosophies and harvest programs than large herbivores. High mobility, low density, complex prey relationships, and propensity to conflict with humans in fact or fiction make large carnivorous species more sensitive to slight but increased selection pressures by sportsmen. As such, management has to be correspondingly more sensitive to changes in the biological parameters of the population.

MANAGEMENT RECOMMENDATIONS

Management Guidelines

Rapid distributional recession and declines in grizzly bear populations occurring with the development of increased human activity has been well documented in Europe and North America (Martinka 1982, US Fish and Wildlife Service 1981, Roben 1980, Cowan 1972, Mysterud 1980, Buchalczyk 1980, Markov 1980, Roth 1976, Elgmork 1978, Grachev 1976, Kaal 1976, Vereschagin 1976, Pearson 1975, Curry-Lindahl 1972, Stebler 1972, Zunino and Herrero 1971, Guilday 1968, Buss 1956 and Storer and Trevis 1955). Human activities within grizzly bear range will continue to have effects, however subtle, on grizzly bears. Management guidelines developed by the Interagency Wildlife Monitoring and Evaluation Program were developed as a direct result of grizzly bear monitoring conducted on the east front (Appendix F). If followed, these guidelines will mitigate but not eliminate detrimental influences of human activities on grizzly bears and grizzly bear habitat.

Cumulative Effects

Recent studies in North America have expressed concerns regarding increasing human access and activities within grizzly bear habitat. The influences of timber harvest, livestock grazing, boneyards and dumps, recreation, sport hunting, road access, mining, subdivision, and hydrocarbon exploitation have been discussed (Craighead 1979, 1980, Craighead and Craighead 1967, 1971, 1973, 1974; Knight et al. 1975, 1976, 1977, 1978, 1980, 1980a, 1981; Chester 1976, Jonkel and Servheen 1977, Jonkel 1976, 1977, 1978, 1980; Harding and Nagy 1980; Schallenberger and Jonkel 1980, Knight and Judd 1980, Blanchard 1978, 1980; Servheen 1981, Pearson 1975, Reynolds and Hechtel 1980, Nagy and Russell 1978, Russell et al. 1978, Hamer et al. 1977, Mundy and Flook 1973). Each activity contributes an additive stress to grizzly bear populations. It is recommended that responsible agencies continue to develop the ongoing cumulative effects model to measure impacts of human activities. Modeling results should be biologically validated using scientific research techniques and the existing grizzly bear data base. Application of the model should occur only after complete development and validation are completed. The model should be continually refined as knowledge and data indicate a need for revision and refinement. Such a project has widespread applicability to all wildlife species concerned.

Research Studies

The relationship of grizzly bears to all types of human activities as well as oil and gas development must be understood. Monitoring programs should be further directed and focused toward filling important gaps in the data base. A summary of existing data is needed to indicate where these gaps exist. Analysis of habitat preference, denning habits, distribution, food habits, movement and home range data should be continued. Intensive efforts to gather data pertaining to livestock/bear relationships, population estimation, oil and gas development impacts, the role of sport hunting, the effects of animal depredation control programs, and the interaction of black and grizzly bears deserve further investigation. Field emphasis should be directed toward securing baseline data in the south half of the Badger-Two Medicine BAU, the area south of the Sun River, and the remote backcountry areas.

Other

Management recommendations were previously presented (Aune et al. (1981, 1982, 1983, 1984, 1985, and 1986)). It is recommended that work continue on the Montana Department of Fish, Wildlife, and Parks zoned management plan for the East Front. Regional Management Plans are essential to proper direction and devising management to achieve specific goals. Efforts should be made to coordinate regional plans with existing interagency programs and recovery objectives for grizzly bears. Mortality and population trend monitoring programs should be outlined in the management plan so that program revisions and refinements can be made.

8072/2

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Appendix A. Portions excerpted from Kasworm (1981) and Ihsle (1982) climatological data.

Month	Station[a]	Temperature (°C) Mean	Temperature (°C) Deviation (°C) from Long-term Average	Precipitation (cm) Amount	Precipitation (cm) Deviation (cm) from Long-Term Average	Precipitation (cm) Snowfall (cm)
Oct. 1979	GD	8.9	+1.8	1.19	-1.78	0.0
	BL	8.3	+1.8	1.14	-0.03	
Nov. 1979	GD	-0.5	-1.2	0.33	-2.72	3.05
	BL	-0.2	+ .2	0.51	-1.12	
Dec. 1979	GD	0.4	+3.2	3.45	-1.09	30.5
	BL	-0.1	+4.2	2.26	+0.86	
Jan. 1980	GD	-9.0	-3.5	3.23	+0.76	42.7
	BL	-10.6	-3.3	2.46	+0.91	
Feb. 1980	GD	-1.6	+1.4	2.08	+0.20	45.7
	BL	-2.9	+1.2	2.08	+0.56	
Mar. 1980	GD	-1.1	+0.5	1.17	-1.45	13.2
	BL	-2.5	-0.7	2.21	+0.53	
Apr. 1980	GD	7.5	+3.4	5.84	+1.96	35.6
	BL	7.2	+3.5	5.33	+1.75	
May. 1980	GD	10.6	+2.0	15.47	+7.32	0.0
	BL	11.3	+2.2	10.26	+1.65	
June 1980	GD	12.5	+0.3	13.13	+2.57	0.0
	BL	--	--	--	--	
July 1980	GD	16.8	+0.3	1.70	-1.78	0.0
	BL	18.2	+1.2	0.61	-2.97	
Aug. 1980	GD	13.9	-2.1	2.62	-1.02	0.0
	BL	13.9	-2.3	3.58	-0.13	

Appendix A continued.

Month	Station[a]	Temperature (°C) Mean	Temperature (°C) Deviation (°C) from Long-term Average	Precipitation (cm) Amount	Precipitation (cm) Deviation (cm) from Long-Term Average	Snowfall (cm)
Sept. 1980	GD	12.6	+1.2	3.48	-0.43	0.0
	BL	11.7	+0.3	2.84	+0.10	
Oct. 1980	GD	8.2	+1.1	3.30	+0.33	--
	BL	8.1	+1.5	3.48	+2.31	7.6
Nov. 1980	GD	2.6	+1.9	1.17	-1.88	11.4
	CH	4.2	+3.2	0.18	-0.91	7.6
Dec. 1980	GD	-3.0	-0.2	2.85	+0.48	24.1
	BL	-7.2	-3.1	1.57	+0.15	2.8
Jan. 1981	GD	0.1	+5.4	0.41	-2.06	--
	BL	0.1	+7.4	0.84	-0.71	--
Feb. 1981	GD	-1.1	+1.8	1.73	-0.15	27.9
	CH	0.4	+3.3	0.23	-0.66	3.8
Mar. 1981	GD	2.4	+4.0	2.11	-0.51	--
	BL	2.2	+4.0	5.82	+4.14	--
Apr. 1981	GD	5.9	+1.8	0.66	-3.23	0.0
	BL	6.2	+2.5	Trace	-3.58	Trace
May 1981	GD	9.3	+0.7	17.70	+9.55	0.0
	CH	11.6	+0.7	8.61	+2.97	0.0
June 1981	GD	11.7	-0.5	4.11	-6.45	0.0
	CH	14.4	-0.4	2.31	-5.97	0.0
July 1981	GD	16.6	+0.1	4.78	+1.30	0.0
	BL	17.4	+0.4	3.07	-0.51	0.0

Appendix A continued.

Month	Station[a]	Temperature (°C) Mean	Deviation (°C) from Long-term Average	Precipitation (cm) Amount	Deviation (cm) from Long-Term Average	Snowfall (cm)
Aug. 1981	GD	17.4	+1.5	4.04	+0.41	0.0
	BL	18.9	+2.6	5.61	-1.91	0.0
Sept. 1981	GD	12.8	+1.5	1.24	-2.67	0.0
	BL	13.2		0.51		0.0
Oct. 1981	GD	5.89	-2.2	2.84	-0.05	--
	CH	7.89	-9.8	2.03	+0.37	4.0
Nov. 1981	GD	3.39	+2.72	0.51	-2.54	2.54
	CH	5.11	+4.11	Trace	-1.09	Trace
Dec. 1981	GD	-3.83	-0.99	2.39	+0.03	19.05
	CH	-3.22	-0.11	0.46	-0.38	0.0
Jan. 1982	GD	-8.72	-3.22	3.22	+1.07	57.91
	CH	-12.49	-6.44	0.86	+0.05	24.64
Feb. 1982	GD	-5.00	-2.05	4.85	+2.97	34.29
	CH	-5.50	-2.55	1.04	+0.15	15.24
Mar. 1982	GD	-0.99	+0.61	4.09	+1.47	59.69
	CH	-1.44	-0.61	0.76	-0.36	24.13
April 1982	GD	2.06	-1.99	2.34	-1.55	27.94
	CH	4.22	-1.50	0.56	-1.57	20.32
May 1982	GD	7.83	-0.78	3.68	-4.47	7.62
	CH	10.28	-0.61	3.76	-1.88	5.08
June 1982	GD	13.28	+1.05	5.92	-4.65	0.0
	CH	15.89	+1.05	6.48	-1.80	0.0

Appendix A continued.

Month	Station[a]	Temperature (°C) Mean	Temperature (°C) Deviation (°C) from Long-term Average	Precipitation (cm) Amount	Precipitation (cm) Deviation (cm) from Long-Term Average	Precipitation (cm) Snowfall (cm)
July 1982	GD	16.28	-0.27	2.18	-1.30	0.0
	CH	10.00	-0.05	2.03	-1.52	0.0
Aug. 1982	GD	16.88	+0.94	2.18	-1.45	0.0
	CH	19.55	+1.56	0.81	-1.93	0.0
Sept. 1982	GD	11.17	-0.17	6.68	+2.77	m[b]
	CH	13.33	+0.55	3.68	+1.17	0.0
Oct. 1982	GD	7.05	-0.02	0.53	-2.44	1.27
	CH	8.72	+0.39	0.13	-0.97	0.0
Nov. 1982	GD	-1.39	-2.05	1.40	-1.65	--
	CH	-0.94	-1.94	0.46	-0.64	--
Dec. 1982	GD	-2.33	-0.50	1.40	-0.97	--
	CH	-2.05	1.06	0.28	-0.56	--
Jan. 1983	GD	0.56	6.56	1.24	-1.73	--
	CH	0.94	7.67	0.13	-0.74	--
Feb. 1983	GD	1.61	4.06	0.23	-1.73	--
	CH	2.28	4.83	0.15	-0.61	--
March 1983	GD	1.06	2.28	5.16	+2.67	--
	CH	2.28	2.50	1.19	+0.28	--
April 1983	GD	3.56	-0.28	1.55	-2.84	--
	CH	5.67	0.16	0.28	-2.08	--
May 1983	GD	8.61	-0.11	4.98	-2.92	--
	CH	11.11	-0.11	1.65	-3.84	--

Appendix A continued.

Month	Station[a]	Temperature (°C) Mean	Temperature (°C) Deviation (°C) from Long-term Average	Precipitation (cm) Amount	Precipitation (cm) Deviation (cm) from Long-Term Average	Precipitation (cm) Snowfall (cm)
June 1983	GD	13.33	+0.56	9.55	+1.02	--
	CH	15.56	+0.00	2.95	-2.73	--
July 1983	GD	16.06	-0.61	4.75	+1.19	--
	CH	18.33	-0.72	4.67	+1.14	--
Aug. 1983	GD	18.72	+2.78	4.22	+0.20	--
	CH	22.22	+3.89	1.27	-1.91	--
Sept. 1983	GD	10.50	-1.06	2.97	-0.30	--
	CH	11.11	-1.00	2.51	+0.38	--
Oct. 1983	GD	8.28	+1.11	0.18	-2.29	0.0
	CH	9.94	+1.33	0.56	-0.56	0.0
Nov. 1983	GD	--	--	--	--	--
	CH	1.94	+1.00	0.74	-2.54	15.24
Dec. 1983	GD	-12.61	-9.56	1.04	-1.57	20.57
	CH	-13.67	-10.50	0.30	-0.53	11.43
Jan. 1984	GD	-0.61	+5.39	1.73	-1.24	12.70
	CH	-0.38	+6.33	0.43	-0.43	17.78
Feb. 1984	GD	2.39	+4.83	0.03	-1.93	1.27
	CH	3.83	+6.39	T	-0.76	1.27
March 1984	GD	0.94	+2.17	2.03	-0.46	12.70
	CH	2.22	+2.44	0.10	-0.81	2.54
April 1984	GD	4.39	+0.56	8.46	+4.06	18.16
	CH	6.50	+1.00	1.78	-0.58	7.62
May 1984	GD	9.33	+0.61	2.74	-5.16	0.0
	CH	11.39	+0.17	1.50	-3.99	0.0

Appendix A continued.

Month	Station[a]	Temperature (°C) Mean	Temperature (°C) Deviation (°C) from Long-term Average	Precipitation (cm) Amount	Precipitation (cm) Deviation (cm) from Long-Term Average	Precipitation (cm) Snowfall (cm)
June 1984	GD	12.83	+0.06	8.61	+0.08	--
	CH	15.94	+0.39	4.24	-2.44	--
July 1984	GD	17.61	+0.94	0.71	-2.84	--
	CH	20.67	+1.33	1.04	-2.49	--
Aug. 1984	GD	18.06	+2.11	4.55	+0.53	--
	CH	21.33	+2.94	1.40	-1.78	--
Sept. 1984	GD	9.22	-2.33	6.02	+2.74	5.08
	CH	10.50	-2.83	2.44	+0.30	22.86
Oct. 1984	GD	3.28	-3.89	2.59	+0.10	40.64
	CH	5.44	-3.17	1.55	+0.43	17.78
Nov. 1984	GD	1.28	+0.78	0.18	-2.67	0.51
	CH	2.22	+1.28	0.00	-0.99	0.00
Dec. 1984	GD	-7.61	-4.56	2.74	+0.13	56.64
	CH	-8.28	-5.11	1.24	+0.41	35.56
Jan. 1985	GD	-4.94	+1.06	0.66	-2.31	8.89
	CH	-4.11	+2.61	0.15	-0.71	7.62
Feb. 1985	GD	-5.44	-3.00	1.35	-0.61	26.67
	CH	-4.33	-1.78	0.15	-0.61	12.70
March 1985	GD	0.00	+1.22	1.75	-0.74	59.69
	CH	1.56	+1.78	0.74	-0.18	27.94
April 1985	GD	6.89	+3.06	1.63	-2.77	2.54
	CH	9.22	+3.72	1.85	-0.51	16.51

Appendix A continued.

Month	Station[a]	Temperature (°C) Mean	Temperature (°C) Deviation (°C) from Long-term Average	Precipitation (cm) Amount	Precipitation (cm) Deviation (cm) from Long-Term Average	Precipitation (cm) Snowfall (cm)
May 1985	GD	11.06	+2.33	5.05	-2.84	0.00
	CH	13.94	+2.72	4.01	-1.47	0.00
June 1985	GD	13.11	+0.33	2.41	-6.12	0.00
	CH	15.83	+0.28	1.52	-5.16	0.00
July 1985	GD	19.39	+2.72	0.41	-3.15	0.00
	CH	22.00	_2.67	0.08	-3.45	0.00
Aug. 1985	GD	14.39	-1.56	13.18	+9.17	0.00
	CH	16.28	-2.11	10.24	+7.06	0.00
Sept. 1985	GD	7.50	-4.06	13.51	+10.24	m
	CH	9.11	-4.22	10.57	+8.43	m
Oct. 1985	GD	5.70	-1.44	4.01	1.52	m20.30
	CH	7.50	-1.11	1.70	0.58	27.90
Nov. 1985	GD	-9.90	-10.44	2.79	-0.05	33.00
	CH	-9.90	-10.89	1.24	0.25	44.45
Dec. 1985	GD	-2.60	0.50	0.30	-2.31	6.36
	CH	-1.80	1.33	0.43	-0.41	10.20
Jan. 1986	GD	2.94	10.33	0.76	-0.69	2.54
	CH	3.67	10.39	0.28	-0.58	7.62
Feb. 1986	GD	-5.17	-2.72	5.36	3.40	77.47
	CH	-6.11	-3.56	1.14	0.38	43.18
March 1986	GD	5.50	6.72	0.69	-1.80	m
	CH	7.22	7.44	0.41	-0.51	m
April 1986	GD	4.72	0.89	3.02	-1.37	17.78
	CH	6.33	0.83	1.63	-0.74	12.70

Appendix A continued.

Month	Station[a]	Temperature (°C) Mean	Deviation (°C) from Long-term Average	Precipitation (cm) Amount	Deviation (cm) from Long-Term Average	Snowfall (cm)
May 1986	GD	9.94	1.22	5.49	-2.41	0.00
	CH	12.72	1.50	2.06	-3.43	0.00
June 1986	GD	16.11	3.33	6.07	-2.46	0.00
	CH	19.06	3.50	5.36	-1.32	0.00
July 1986	GD	15.11	-1.56	2.13	-1.42	0.00
	CH	18.22	-1.11	1.63	-1.91	0.00
August 1986	GD	16.83	0.89	7.19	3.18	0.00
	CH	20.28	1.89	3.86	0.69	0.00
Sept. 1986	GD	8.83	-2.72	11.61	8.33	0.00
	CH	10.33	-3.00	7.75	5.61	0.00

a = GD - Gibson Dam, BL - Blackleaf, CH = Choteau

b = missing at least some data

Appendix B. Species and common names of East Front Rocky Mountain plants. Arranged alphabetically by life form. Nomenclature follows Hitchcock and Cronquist (1974). (Carex follows Hermann 1970.) Sources where species were reported in literature include: 1. Harvey (1980); 2. Lessica (1982); 3. Kasworm (1980); 4. Ihsle (1981); 5. Thompson (1980); and 6. Joslin (1982). Plant collections are kept by (A) Bureau of Land Management; (B) Montana Department of Fish, Wildlife and Parks, and (C) The Nature Conservancy.

Plant No.	Scientific binomial	Common name	Source	Plant Collection
Trees				
0010	Abies lasiocarpa	Subalpine fir	5,6	
0020	Juniperus scopulorum	Rocky Mtn. juniper	1,3,4	A,B
0030	Picea engelmannii	Engelman spruce	1,2,3,4	A,B,C
0040	Pinus albicaulis	Whitebark pine	6	
0050	Pinus contorta var. latifolia	Lodgepole pine	1,3,4	A,B
0060	Pinus flexilis	Limber pine	1,3,4,5,6	A,B
0065	Populus angustifolia	Narrow-leaf cottonwood	2	C
0070	Populus tremuloides	Quaking aspen	1,2,3,4	A,B,C
0080	Populus trichocarpa	Black cottonwood	1,2	A,C
0090	Pseudotsuga menziesii	Rocky Mtn. douglas fir	1,2,3,4,5,6	A,B,C
0100	Total Trees			
Tall Shrubs				
0110	Acer glabrum	Rocky Mountain maple	1,6	A,B
0120	Alnus sinuata	Sitka alder		A,C
0130	Betula glandulosa	Bog birch	2	
0140	Betula occidentalis/occidentalis	Water birch	1,2,3,4,	A,B,C
0145	Betula spp.	Genera		
0150	Cornus stolonifera/stolonifera	Red-osier dogwood	1,2	A,C
0160	Elaeagnus commutata	Silverberry	1,2,3,4	A,B,C
0170	Salix brachycarpa	Short fruited willow		A
0180	Salix bebbiana/perrostrata	Bebb willow	1,2,3	A,B,C
0185	Salix candida	Hoary willow	2	C
0190	Salix commutata	Variable willow		A
0200	Salix drummondiana	Drummond willow	2	A,C
0210	Salix exigua ssp exigua/stenophylla	Narrow-leaf willow	1,2	B,C
0220	Salix monticola	Mountain willow	1,2	A,C

Plant No.	Scientific binomial	Common name	Source	Plant Collection
0230	Salix myrtillifolia	Blueberry willow	1,2	A,C
0238	Salix phylicifolia/planifolia	Tea-leaved willow	2	C
0240	Salix rigida/mackenzieana	Mackenzie willow	1	A,B
0241	Salix rigida/watsonii	Watson willow	2	C
0250	Salix scouleriana	Scouler willow	1	A
0253	Salix serrissima	Fall willow	2	C
0260	Salix spp.	Genera		
0261	Sorbus sitchensis	Mountain ash		
0265	Total Tall Shrubs			
	Medium Shrubs			
0270	Amelanchier alnifolia/alnifolia	Western serviceberry	1,2,3,4,6	A,B,C
0280	Artemesia tridentata ssp. vaseyana	Mountain big sagebrush	1,3,4	A,B
0285	Cercocarpus ledifolus	Curly leafed mountain mahogany		
0290	Chrysothamnus nauseosus/petrophilus	Common rabbit-brush	1	B
0295	Crataegus douglasii	Hawthorn		
0300	Juniperus communis/montana	Common juniper	1,2,3,4,6	A,B,C
0310	Lonicera involucrata	Black twin-berry		A
0320	Lonicera utahensis	Utah honeysuckle		A
0325	Menziesia ferrigina	Menziesia		
0330	Philadelphus lewisii	Mockorange	1,6	B
0340	Potentilla fruticosa	Shrubby cinquefoil	1,2,3,4,5,6	A,B,C,
0350	Prunus virginiana/melanocarpa	Common chokecherry	1,2,3,4,6	A,B,C
0360	Rhus trilobata	Skunkbush sumac	1,3,4	A,B
0365	Ribest americanam	Black currant		
0370	Ribes cereum/inebrians	Squaw currant	1,2,3,4	A,B,C
0380	Ribes inerme	Whitestem gooseberry	1,3,4	A,B
0390	Ribes lacustre	Prickly currant	1	A,B
0400	Ribes montigenum	Sticky currant		
0410	Ribes setosum	Missouri gooseberry	2	C
0415	Ribes viscosissimum	Sticky currant	6	A
0420	Ribes ssp.	Genera		
0430	Rosa acicularis	Prickly rose	1	B
0440	Rosa arkansana	Arkansas rose	1,3	A,B
0450	Rosa woodsii/ultramontana	Pearhip rose	1,2,3	A,B,C
0460	Rosa spp.	Genera		
0470	Rubus idaeus/peramoenus	Red raspberry	1,2,6	B,C
0480	Rubus parviflorus	Thimbleberry	1	B

Plant No.	Scientific binomial	Common name	Source	Plant Collection
0489	Sambucus cerulea	Blue elderberry		
0490	Sambucus racemosa	Black elderberry		
0500	Shepherdia argentea	Thorny buffalo-berry		A
0510	Shepherdia canadensis	Canada buffalo-berry	1,2,3,4,5,6	A,B,C
0520	Spirea betulifolia/lucida	Shiny-leaf spirea	1,2,3,4,6	A,B,C
0523	Spirea densiflora	Subalpine spirea		
0525	Spirea spp.	Genera		
0530	Symphoricarpos albus/albus	Common snowberry	1,3,6	A,B
0540	Symphoricarpos occidentalis	Western snowberry	2,3,4	A,C
0542	Symphoricarpos oreophilus	Mtn. snowberry		
0550	Tetradymia canescens	Gray horse-brush	1	B
0560	Vaccinium globulare	Globe huckleberry	6	A
0565	Total Medium Shrubs			
	Low Shrubs and Vines			
0570	Arctostaphylos uva-ursi	Kinnikinnick	1,2,3,4,5,6	A,B,C
0575	Artemesia biennis	Biennial wormwood	1,2	B,C
0578	Artemesia campestris ssp borealis/ scouleriana	Northern wormwood	1,3,4	A,B
0580	Artemisia cana	Hoary sagewort	3	A
0582	Artemesia dracunculus	Dragon sagewort	1	B
0585	Artemisia frigida	Fringed sagewort	1,3,4	A,B
0588	Artemesia ludoviciana/ludoviciana	Cudweed sagewort	1,3,4	A,B
0589	Artemesia ludoviciana/latiloba	Western mugwort	1	B
0590	Artemesia michauxiana	Michaux mugwort	1,5	B
0595	Artemesia spp.			
0600	Berberis repens	Oregongrape	1,2,3,4,6	A,B,C
0605	Chimaphila umbellata	Common priucas pine		A
0610	Clematis columbiana/columbiana	Columbia clematis	1,6	A,B
0620	Clematis ligusticifolia	Western clematis	1,2	B,C
0630	Clematis pseudoalpina	Climbing purple virgins-bower	3,4,6	A
0640	Clematis tenuiloba	Matted purple virgins-bower		
0650	Dryas octopetala/hookeriana	White dryas	1,5,6	B
0660	Gutierrezia sarothrae	Broom snakeweed	1	B
0670	Juniperus horizontalis	Creeping juniper	1,2,3,4,6	A,B,C
0675	Linnea borealis	Twinflower		A
0680	Ledum glandulosum	Mountain labrador-tea		A
0685	Phyllodace empetriformis	Pink mountain heather		
0690	Vaccinium myrtillus	Dwarf huckleberry		A
0699	Vaccinium caespitosum	Dwarf bilberry		

Plant No.	Scientific binomial	Common name	Source	Plant Collection
0700	Vaccinium scoparium	Whortleberry		
0710	Total Low shrubs and Vines			
	Ferns and Fern Allies			
0712	Athyrium filix-femina	Lady-fern	2	C
0715	Botrychium virginianum	Virginia grape-fern	2	C
0717	Cystopteris fragilis	Brittle bladder-fern	1	B
0720	Equisetum arvense	Common horsetail	1,2	B,C
0730	Equisetum fluviatile	Water horsetail		
0740	Equisetum laevigatum	Smooth scouring-rush	1,2	A,B,C
0750	Equisetum pratense	Shady horsetail		
0755	Equisetum spp.	Genera		
0760	Equisetum variegatum	Northern scouring-rush	2	C
0770	Mushroom spp.			
0780	Selaginella densa/densa	Compact selaginella	1,4,6	B
0790	Thelypteris phegoptesis	Wood fern		
0798	Woodwardia fimbriata	Chain-fern	6	
0800	Total Ferns and Fern Allies			
	Graminoides			
0810	Agropyron caninum spp. majus/majus	Slender wheatgrass	1,2,4,5,6	A,B,C
0820	Agropyron caninum spp. majus/andinum	Bearded wheatgrass	1,2	B,C
0825	Agropyron Caninum ssp. majus/latiglume	Broad glumed wheatgress		
0830	Agropyron cristatum	Crested wheatgrass	1	B
0840	Agropyron dasytachyum	Thick-spiked wheatgrass	1,3,4	A,B
0845	Agropyron intermedium	Intermediate wheatgress		
0850	Agropyron repens	Quack grass	1,2	C
0860	Agropyron scribneri	Spreading wheatgrass	5	
0870	Agropyron smithii	Western wheatgrass	1,2,6	B,C
0880	Agropyron spicatum/spicatum	Bluebunch wheatgrass	1,3,4,6	A,B
0890	Agropyron spp.	Genera		
0900	Agrostis alba/alba	Redtop	1,2	B,C
0905	Agrostis thurberiana	Thurber bentgrass	6	
0907	Agrostis spp.	Genera		
0910	Alopecurus aequalis	Short-awn foxtail	2	C
0911	Alopecurus alpinus	Alpine foxtail	1,2	B,C
0918	Alopecurus geniculatus	Water foxtail	2	
0920	Andropogon scoparius	Little bluestem	1	B

Plant No.	Scientific binomial	Common name	Source	Plant Collection
0930	Aristida fendleriana	Fendlers threeawn	1	B
0940	Aristida longiseta/robusta	Red threeawn	1	B
0950	Avena fatua	Wild oat	1	B
0960	Beckmannia syzigachne	American sloughgrass	1,2	B,C
0970	Bouteloua gracilis	Blue grama	1	B
0980	Bromus carinatus/carinatus	Mountain brome	1,2,3,4,5	A,B,C
0990	Bromus carinatus/linearis	California brome	1	B
0993	Bromus ciliatus	Fringed brome	2,5	C
1000	Bromus inermis spp. inermis	Smooth brome	1,2,3,4,5	A,B,C
1010	Bromus inermis spp. pumpellianus/ pumpellianus	Pumpelly brome	1	B
1020	Bromus japonicus	Japanese brome	1	B
1030	Bromus tectorum	Cheatgrass	1,3,4	A,B
1035	Bromus spp.			
1040	Calamagrostis canadensis	Bluejoint reedgrass		A
1050	Calamagrostis inexpansa/inexpansa	Narrow-spiked reedgrass	1,2	B,C
1055	Calamagrostis montanensis	Plains reedgrass	2	C
1060	Calamagrostis neglecta/neglecta	Slimstem reedgrass	1	B
1070	Calamagrostis purpurascens	Purple pinegrass	1,5,6	A,B
1080	Calamagrostis rubescens	Pinegrass	1,4,6	B
1090	Calamovilfa longifolia	Prairie sand reedgrass	1	B
1100	Carex aquatilis	Water sedge	1,2	B,C
1101	Carex atherodes	Awned sedge	2	C
1102	Carex athrostachya	Slenderbeaked sedge	2	C
1103	Carex aurea	Golden sedge	2	C
1105	Carex buxbaumii	Buxbaum's sedge	2	C
1107	Carex capillaris	Hair sedge	2	C
1110	Carex concinnoides	Northwest sedge		
1111	Carex crawei	Craw's sedge	2	C
1115	Carex diandra	Panicled sedge	2	C
1116	Carex dioica	Yellow bog sedge	2	C
1117	Carex disperma	Soft leaved sedge	2	C
1118	Carex douglasii	Douglas' sedge	2	C
1120	Carex filifolia	Thread-leaved sedge	1,3,4	A,B
1130	Carex geyeri	Elk sedge	1,6	B
1140	Carex hoodii	Wire sedge	1	B
1143	Carex interior	Inland sedge	2	C
1150	Carex lanuginosa	Woolly sedge	1,2	B,C
1151	Carex lasiocarpa	Slender sedge	2	C
1152	Carex leptalea	Bristle-stalked sedge	2	C

Plant No.	Scientific binomial	Common name	Source	Plant Collection
1153	Carex limosa	Shore sedge	2	C
1154	Carex livida	Pale sedge	2	C
1160	Carex microptera	Small-winged sedge	2	A,C
1170	Carex muricata	Muricate sedge		A
1180	Carex nebraskensis	Nebraska sedge	2,3,4	A,C
1183	Carex oederi	Green sedge	2	C
1188	Carex parryana	Parry sedge	2	C
1190	Carex praegracilis	Clustered field sedge	1,2	B,C
1200	Carex raynoldsii	Raynolds' sedge		A
1205	Carex rossii	Ross sedge	6	
1210	Carex rostrata	Beaked sedge	1,2	B,C
1220	Carex rupestris/drummondii	Curly sedge	1	B
1227	Carex sartwellii	Sartwell's sedge	2	C
1230	Carex scirpoidea	Single-spiked sedge	1,2	B,C
1233	Carex simulata	Short-beaked sedge	2	C
1240	Carex stenophylla	Narrow-leaved sedge	2,4	C
1250	Carex xerantica	Dryland sedge	3,4	A
1260	Carex spp.	Genera		
1270	Dactylis glomerata	Orchard-grass	1,2	B,C
1275	Danthonia californica	California oatgrass	2	C
1280	Danthonia intermedia	Timbered oatgrass	4,6	
1290	Danthonia parryi	Parry's oatgrass	1	B
1300	Danthonia unispicata	Few-flowered wild oatgrass	4	
1310	Danthonia spp.	Genera		
1320	Deschampsia cespitosa/cespitosa	Tufted hairgrass	1,2,5,6	B,C
1330	Deschampsia elongata	Slender hairgrass	3,4	A
1340	Distichlis stricta/stricta	Alkali saltgrass	1	B
1350	Echinochloa crusgalli	Large barnyard-grass		
1360	Eleocharis acicularis	Needle spike-rush	1	B
1370	Eleocharis palustris	Common spike-rush	1,2	B,C
1371	Eleocharis parvula	Small spike-rush	2	C
1372	Eleocharis pauciflora	Few-flowered spike-rush	2	C
1375	Eleocharis tenuis	Slender spike-rush	2	C
1380	Elymus cinereus/cinereus	Basin wildrye	1	B
1390	Elymus glaucus	Western rye-grass	2	A,C
1395	Eriophorum polystachion	Cotton-grass	2	C
1397	Eriophorum scheuchzeri	Cotton-grass		
1400	Eriophorum viridicarinatum	Green keeled cotton-grass	2	C
1410	Festuca idahoensis/idahoensis	Idaho fescue	1,3,4,5,6	A,B
1420	Festuca ovina	Sheep fescue	4,5,6	

Plant No.	Scientific binomial	Common name	Source	Plant Collection
1430	Festuca pratensis	English fescue	1,2	B,C
1440	Festuca scabrella	Rough fescue	1,3,4,5,6	A,B
1450	Glyceria grandis	American mannagrass	1,2	B,C
1452	Glyceria striata	Fowl mannagrass	2	C
1460	Helictotrichon hookeri	Spike-oat	1,4	B
1470	Hordeum jubatum	Foxtail barley	1,2	B,C
1480	Juncus alpinus	Northern rush	1,2	B,C
1490	Juncus balticus/montanus	Wire rush	1,2	B,C
1492	Juncus bufonius	Toad rush	2	C
1500	Juncus longistylis	Long-styled rush	2,3,4	A,C
1510	Juncus nodosus	Tuberous rush	1,2	B,C
1515	Juncus tenuis	Slenber rush	2	C
1516	Juncus torreyi	Torry's rush	2	C
1520	Juncus trayci	Tracy's rush	1,2	B,C
1530	Juncus spp.	Genera		
1540	Koeleria cristata	Prairie junegrass	1,3,4,6	A,B
1550	Luzula hitchcockii	Smooth woodrush		A
1560	Muhlenbergia cuspidata	Plains muhly	1,3,4	A,B
1565	Muhlenbergia glomerata	Marsh muhly	2	C
1567	Muhlenbergia richardsonis	Mat muhly	2	C
1568	Muhlenbergia spp.	Genera		
1570	Oryzopsis hymenoides	Indian ricegrass	1	B
1580	Phalaris arundinacea	Reed canarygrass	1,2	B,C
1590	Phleum alpinum	Alpine timothy	5,6	
1600	Phleum pratense	Common timothy	1,2,3,4	A,B,C
1603	Poa alpina		Alpine bluegrass 5,6	
1605	Poa annua		Annual bluegrass 2 C	
1610	Poa compressa	Canada's bluegrass	1	B
1620	Poa cusickii	Cusick's bluegrass	3,5	A
1625	Poa fendleriana	Muttongrass	6	
1630	Poa interior	Inland bluegrass	2,5	C
1635	Poa juncifolia	Alkali bluegrass	2	C
1640	Poa nervosa/wheeleri	Wheeler's bluegrass	1,5	B
1650	Poa nevadensis	Nevada bluegrass	1	B
1660	Poa pratensis	Kentucky bluegrass	1,2,3,4,6	A,B,C
1670	Poa rupicola	Timberline bluegrass	5	
1680	Poa sandbergii	Sandberg's bluegrass	1,3,4,5,6	A,B
1690	Poa scabrella	Pine bluegrass	2	C

Plant No.	Scientific binomial	Common name	Source	Plant Collection
			Genera	
1700	Poa spp.	Weeping alkaligrass	2	C
1705	Puccinellia distans	Hardstem bulrush	1,2	B,C
1710	Scirpus acutus	American bulrush	2	C
1711	Scirpus americanus	Seacoast bulrush	2	C
1719	Scirpus maritimus	Small-fruit bulrush	1,2	B,C
1720	Scirpus microcarpus	Genera		
1725	Scirpus spp.	Squirreltail	5,6	
1727	Sitanion hystrix	Alkali cordgrass	1,2	B,C
1730	Spartina gracilis	Needle and thread	1,4	B
1740	Stipa comata/comata	Western needlegrass	1,3,4	A,B
1750	Stipa occidentalis/minor	Porcupine needlegrass	1	B
1760	Stipa spartea/curtiseta	Richardson's needlegrass		
1770	Stipa richardsonii	Green needlegrass	1,3,4	A,B
1780	Stipa viridula	Tall trisetum		
1790	Trisetum canescens	Downy oatgrass	5	A
1800	Trisetum spicatum	Common cattail	1	B
1803	Typha latifolia			
1805	Unknown cyperaceos			
1810	Unknown graminae			
1815	Unknown juncaceae			
1820	Total Graminoids			
	Forbs			
1830	Achillea millefolium ssp. lanulosa/ lanulosa	Common yarrow	1,2,3,4,5,6	A,B,C
1840	Actea rubra	Western red baneberry	1,2	B,C
1850	Actea rubra/neglecta	Western white baneberry	1	B
1860	Agoseris glauca/dasycephala	Pale agoseris	1,3,4,6	A,B
1862	Agoseris aurantiaca	Orange agoseris		
1865	Agoseris spp.	Genera		
1870	Allium cernuum	Nodding onion	1	B
1878	Allium schoenoprasum	Chives	2	C
1880	Allium textile	Textile onion	1,3,4	A,B
1890	Allium spp.	Genera		
1900	Alyssum alyssoides	Pale alyssum	1,3,4	A,B
1910	Amaranthus californicus	California amaranth	1	B
1915	Anaphalis margaritacea	Pearly-everlasting		
1920	Androsace lehmanniana	Sweet-flowered androsace	1,6	B

Plant No.	Scientific binomial	Common name	Source	Plant Collection
1930	Androsace septentrionalis	Northern androsace	1,6	B
1940	Anemone multifida/multifida	Pacific anemone	1,2,3,5,6	A,B,C
1950	Anemone nuttalliana	Pasqueflower	3,6	A
1960	Anemone parviflora	Small-flowered anemone	2	C
1970	Anemone piperi	Piper's anemone		
1975	Anemone spp.	Genera		
1980	Angelica arguta	Sharptooth angelica	1,2	A,B,C
1990	Angelica spp.	Genera		
1995	Antennaria alpina	Alpine pussy-toes	6	
2000	Antennaria anaphaloides	Tall pussy-toes	1,2	A,B,C
2005	Antennaria arcuata	Arching pussy-toes		B
2010	Antennaria microphylla	Rosy pussy-toes	1,2,3,4	A,B,C
2012	Antennaria neglecta	Field pussy-toes	6	
2020	Antennaria parvifolia	Nuttall's pussy-toes	1	B
2030	Antennaria racemosa	Raceme pussy-toes	1	A,B
2032	Antennaria rubella		6	
2035	Antennaria spp.	Genera		
2036	Antennaria umbrinella	Umber pussy-toes	6	
2040	Apocynum medium	Western dogbane	1,4	B
2050	Aquilegia flavescens	Yellow columbine	1,3	A,B
2060	Aquilegia jonesii	Limestone columbine		A
2063	Arabis glabra	Towermustard	2	C
2065	Arctium minus	Burdock	2	C
2066	Arctium lappa	Burdock		
2070	Arenaria capillaris/americana	Thread-leaved sandwort	1,5	B
2080	Arenaria congesta	Ballhead sandwort	3,4,6	A
2085	Arenaria hookeri	Hooker's sandwort	6	
2090	Arenaria lateriflora	Bluntleafed sandwort	2	C
2095	Arenaria nuttallii	Nuttals sandwort		
2100	Arenaria obtusiloba	Arctic sandwort	1,5	B
2110	Arenaria rossii/apetala	Ross sandwort	1	B
2112	Arenaria aculeata	Prickly sandwort		
2115	Arenaria spp.	Genera		
2118	Arnica alpina	Alpine arnica	6	
2120	Arnica cordifolia/cordifolia	Heart-leaf arnica	1,2,3,4,6	A,B,C
2130	Arnica fulgens	Orange arnica	1	B
2140	Arnica latifolia	Mountain arnica		
2142	Arnica longifolia	Seep-spring arnica	6	
2150	Arnica mollis	Hairy arnica	5	

Plant No.	Scientific binomial	Common name	Source	Plant Collection
2151	Arnica parryi	Nodding arnica		
2152	Arnica rydbergii	Rydberg's arnica	6	
2155	Arnica spp.	Genera		
2183	Aster alpigenus	Alpine aster	6	
2185	Aster chilensis ssp. adscendens	Long-leaved aster	1	B
2186	Aster conspicuus	Showy aster	1,6	B
2190	Aster foliaceus/parryi	Leafy aster	1,6	B
2200	Aster hesperius	Western willow aster	1	B
2202	Aster integrifolius	Thick-stemmed aster	6	
2205	Aster junciformis	Rush aster	2	C
2210	Aster laevis/geyeri	Smooth aster	1,2	B,C
2220	Aster modestus	Few-flowered aster	1	B
2225	Aster occidentalis	Mountain aster	2	C
2230	Aster pansus	White prairie aster	1	A,B
2235	Aster sibiricus	Arctic aster	6	
2240	Aster spp.		Genera	
2250	Astragalus adsurgens	Standing milk-vetch	3,4	A
2260	Astragalus alpinus	Alpine milk-vetch	6	
2263	Astragalus argophyllus/argophyllus	Silver-leaved milk-vetch	1	B
2270	Astragalus bisulcatus	Two-grooved milk-vetch	1,3,4	A,B
2272	Astragalus bourgovii	Bourgeau's milk-vetch	6	
2275	Astragalus canadensis	Canada milk-vetch	2	C
2280	Astragalus cibarius	Browse milk-vetch	1	B
2285	Astragalus crassicarpus	Ground plum		
2290	Astragalus drummondii	Drummond's milk-vetch	1,3,4	A,B
2295	Astragalus eucosmus	Elegant milk-vetch	6	
2300	Astragalus gilviflorus	Plains orophaca	1,3,4	A,B
2305	Astragalus misellus	Pauper milk-vetch	6	
2310	Astragalus miser	Weedy milk-vetch		A
2320	Astragalus missouriensis	Missouri milk-vetch		
2323	Astragalus purshii	Pursh's milk-vetch	1,6	B
2325	Astragalus robbinsii	Robbins' milk-vetch		
2329	Astragalus vexilliflexus	Bent-leaved milkvetch	6	
2330	Astragalus spp.	Genera		
2340	Bahia oppositifolia	Bahia	1	B
2350	Balsamorhiza incana	Hoary balsamroot	4	
2360	Balsamorhiza sagittata	Arrowleaf balsamroot	1,3,4,6	A,B
2370	Barbarea orthoceras	American wintercress	1	B
2380	Besseya wyomingensis	Wyoming besseya	3,4,6	A
2385	Boisduvalia glabella	Spike-primrose	2	C

Plant No.	Scientific binomial	Common name	Source	Plant Collection
2390	Bupleurum americanum	American thorough-wax	1,3,4,5	A,B
2395	Callitriche hermaphroditica	Northern water-starwort	2	C
2396	Callitriche heterophylla	Different-leaved water-starwort	2	C
2397	Calochortus gunnisonii	Sago lilly		
2398	Calypso bulbosa	Fairy slipper		
2400	Campanula rotundifolia	Scotch bluebell	1,2,3,4,5,6	A,B,C
2410	Capsella bursa-pastoris	Shepherd's-purse	1,2	B,C
2415	Carduus nutans	Musk thistle	3	A
2420	Carum carvi	Caraway	1,2	B,C
2430	Castilleja lutescens	Yellowish paintbrush	1,3,4	A,B
2440	Castilleja miniata/miniata	Common paintbrush	1,2	B,C
2445	Castilleja rhexifolia	Rhexia-leaved paintbrush	6	
2450	Castilleja sessiliflora	Downy painted-cup	1	B
2453	Castilleja sulphurea	Sulphur paintbrush	2	C
2455	Castilleja spp.	Genera		
2460	Centaurea maculosa	Spotted knapweed	1	A,B
2470	Cerastium arvense	Field chickweed	1,2,3,4,6	A,B,C
2480	Cerastium berringianum	Alpine chickweed	5,6	
2485	Cerastium vulgatum	Common chickweed	6	
2490	Cerastium spp.	Genera		
2500	Chenopodium album	Lambsquarter	1,2	B,C
2510	Chenopodium chenopodioides	Red goosefoot		
2520	Chenopodium fremontii/atrovirens	Fremont's goosefoot	1	B
2530	Chenopodium rubrum	Red goosefoot	1	B
2532	Chenopodium spp.	Genera		
2540	Chrysopsis villosa/foliosa	Hairy golden-aster	1,3,4	A,B
2550	Cicuta douglasii	Douglas' water-hemlock	1,2	B,C
2560	Cirsium arvense/horridum	Canadian thistle	1,2	B,C
2570	Cirsium scariosum	Elk thistle		
2580	Cirsium undulatum	Wavy-leaved thistle	1	B
2590	Cirsium vulgare	Bull thistle	1,2,4	A,B,C
2600	Cirsium spp.	Genera		
2610	Clematis hirsutissima	Douglas' clematis	1,3,4,6	A,B
2620	Claytonia lanceolata	Springbeauty		A
2630	Claytonia megarhiza	Alpine claytonia	6	A
2640	Collomia linearis	Narrow-leaf collomia	1,3,4	A,B
2650	Collinsia parviflora	Small-flowered blue-eyed Mary	3,4,6	A
2660	Comandra umbellata	Bastard toad-flax	1,3,4	A,B

Plant No.	Scientific binomial	Common name	Source	Plant Collection
2670	Conimitella williamsii	Williams conimitella	1	B
2680	Conringia orientalis	Hare's-ear mustard	1	B
2690	Convolvulus arvensis	Small bindweed	1	B
2692	Corallorhiza striata	Striped coral-root	2	C
2693	Corallorhiza trifida	Yellow coral-root	2	C
2700	Corydalis aurea	Golden corydalis		A
2710	Coryphantha vivipara	Cushion cactus	1	B
2720	Crepis acuminata	Long-leaved hawksbeard	1,4	B
2725	Crepis occidentalis	Western hawksbeard	3	A
2727	Crepis runcinata	Meadow hawksbeard	2	C
2730	Cruciferae spp.	Family		
2740	Cryptantha interrupta	Bristly cryptantha	1,3,4	A,B
2750	Cryptantha nubigena	Sierra cryptantha	1	B
2755	Cryptantha spp.	Genera		
2760	Cynoglossum officinale	Common hound's-tongue	1,2	B,C
2770	Cypripedium calceolus	Yellow lady's-slipper	2	A,C
2775	Cypripedium montanum	White lady's-slipper	2	C
2780	Descurainia pinnata	Western tansymustard	3,4	A
2790	Descurainia sophia	Flixweed	1	B
2800	Delphinium biocolor	Little larkspur		A
2810	Diplotaxis muralis	Wall rocket	1	B
2820	Disporum trachycarpum	Rough-fruited fairy-bell	1,2	A,B,C
2830	Dodecatheon conjugens	Slimpod shooting star	3	A
2840	Dodecatheon pulchellum	Few-flowered shooting star	2	C
2850	Douglasia montana	Rocky Mountain douglasia	1,3,4,6	A,B
2852	Draba lonchocarpa	Lancefruit draba	6	
2855	Draba nemorosa	Whitlow-wort	2	C
2860	Draba oligosperma/oligosperma	Few-seeded draba	1,6	B
2865	Draba oreibata	Limestone draba	6	
2867	Draba paysonii	Payson's draba	6	
2870	Draba reptans	Carolina whitlow-grass	3,4,6	A
2872	Draba spp.	Genera		
2873	Elatine americana	Mud-purslane	2	C
2874	Epilobium alpinum	Alpine fire-weed	6	
2875	Epilobium angustifolium	Fireweed	1,2,6	B,C
2880	Epilobium glandulosum	Common willow-weed	2,5	C
2885	Epilobium palustre	Swamp willow-weed	2	C
2890	Epilobium watsonii/watsonii	Watson's willow-weed	1,2	B,C
2900	Erigeron caespitosus	Tufted fleabane	1,4	B

Plant No.	Scientific binomial	Common name	Source	Plant Collection
2910	Erigeron compositus/glabratus	cut-leaved daisy	1,6	A,B
2912	Erigeron glabellus	Smooth daisy	2	C
2913	Erigeron grandiflorus	Large-flowered daisy	6	
2914	Erigeron humilis	Arctic-alpine daisy	6	
2916	Erigeron lanatus	Woolly daisy	6	
2917	Erigeron lonchophyllus	Short-rayed daisy	2	C
2920	Erigeron ochroleucus/ochroleucus	Buff fleabane	1,3,4	A,B
2923	Erigeron peregrinus	Subalpine daisy	6	
2925	Erigeron pumilis	Shaggy fleabane	6	
2928	Erigeron simplex	Alpine daisy	6	
2930	Erigeron speciosus/speciosus	Showy fleabane	1,2,3,4	A,B,C
2940	Erigeron spp.	Genera		
2950	Eriogonum flavum/flavum	Yellow buckwheat	1,3,4	A,B
2955	Eriogonum heracleoides	Wyeth buckwheat		
2960	Eriogonum mancum	Imperfect buckwheat		A
2970	Eriogonum ovalifolium/macropodum	Cushion buckwheat	1,6	B
2980	Eriogonum umbellatum/subalpinum	Sulphur buckwheat	1,6	B
2990	Eriogonum spp.	Genera		
2995	Eriophyllum lanatum	Wooly sunflower		
3000	Eritrichium howardii	Howard's alpine forget-me-not	3,4	A
3010	Eritrichium nanum	Pale alpine forget-me-not	A	
3020	Erodium cicutarium	Stork's-bill	1	B
3030	Erysimum asperum	Prairie rocket		A
3032	Erysimum cheiranthoides	Treacle mustard	2	C
3034	Erysimum repandum	Wallflower	2	C
3040	Erythronium grandiflorum	Glacier-lily	6	A
3050	Euphorbia esula	Spurge		A
3060	Fragaria virginiana/glauca	Blueleaf strawberry	1,2,3,4,5,6	A,B,C
3070	Frasera speciosa	Giant-frasera	4,6	
3080	Fritillaria pudica	Yellow bell	1	B
3090	Gaillardia aristata	Blanket-flower gaillardia	1,3,4	A,B
3095	Galium aparine	Goose-grass	2	C
3100	Galium boreale	Northern bedstraw	1,2,3,4,5,6	A,B,C
3105	Galium trifidum	Small bedstraw	2	C
3110	Galium triflorum	Fragrant bedstraw	1,6	A,B
3120	Gaura coccinea	Scarlet guara	1,3,4	A,B
3130	Gentiana affinis	Pleated gentian	1,2	A,B,C
3132	Gentiana amarella	Northern gentian	2	C

Plant No.	Scientific binomial	Common name	Source	Plant Collection
3140	Gentiana calycosa	Mountain bog gentian	5,6	
3150	Gentiana detonsa	Smaller fringed gentian	2	A,C
3155	Gentiana spp.	Genera		
3160	Geranium richardsonii	White geranium	1,2	A,B,C
3170	Geranium viscosissimum/ viscosissimum	Sticky geranium	1,3,4,6	A,B
3175	Geranium spp.	Genera		
3180	Geum aleppicum	Yellow avens	1,2	B,C
3190	Geum macrophyllum/macrophyllum	Large-leaved avens	1,2,4	B,C
3200	Geum triflorum/triflorum	Prairie smoke avens	1,3,4,6	A,B
3205	Glaux maritima	Saltwort	2	C
3210	Glycyrrhiza lepidota/lepidota	American licorice	1,2	A,B,C
3220	Goodyera oblongifolia	Western rattlesnake-plantain		A
3225	Gratiola ebracteata	Hedge-hyssop	2	C
3230	Grindelia squarrosa/quasiperennis	Curly-cup gumweed	1,2	A,B,C
3235	Guttierrezia sarothrae	Matchbrush	3,4	A
3240	Habenaria dilatata	White bog-orchid	1	B
3250	Habenaria hyperborea	Northern green bog-orchid	1,2	B,C
3255	Habenaria saccata	Slender bog-orchid	2	C
3257	Habenaria spp.			
3260	Habenaria unalascensis	Alaska bog-orchid		
3265	Habenaria viridis	Frog orchid	2	C
3270	Hackelia floribunda	Many-flowered stickseed	2,6	A,C
3280	Hackelia micrantha	Blue stickseed		
3285	Haplopappus integrifolius	Entire-leaved goldenweed	2	C
3287	Haplopappus lyallii	Lyall's goldenweed	6	
3290	Hedysarum alpinum	Alpine hedysarum	5	
3300	Hedysarum boreale/cinerascens	Northern hedysarum	1	A,B
3305	Hedysarum spp.	Genera		
3310	Hedysarum sulphurescens	Yellow hedysarum	1,3,4,5	A,B
3315	Helianthella uniflora	Rocky Mtn. helianthella		
3320	Helianthus annuus	Common sunflower	1	B
3330	Helianthus nuttallii/nutallii	Nutall's sunflower	1,2	B,C
3340	Helianthus rigidus/subrhomboideus	Showy sunflower	1	B
3342	Helianthus spp.	Genera		
3350	Heracleum lanatum	Cow-parsnip	1,2,6	A,B,C
3360	Heuchera cylindrica/glabella	Roundleaf alumroot	1,3,4	A,B,
3370	Heuchera parvifolia/dissecta	Common alumroot	1,6	A,B

Plant No.	Scientific binomial	Common name	Source	Plant Collection
3375	Heuchera spp.	Genera		
3377	Hieracium cynoglossoides	Hounds-tongue hawkweed	6	
3380	Hieracium gracile	Alpine hawkweed		A
3390	Hieracium umbellatum	Narrow-leaved hawkweed	2	C
3395	Hieracium spp.	Genera		
3398	Hippuris vulgaris	Mare's-tail	2	C
3400	Hydrophyllum capitatum	Ballhead waterleaf	6	A
3410	Hymenopappus filifolius/ polycephalus	Cut-leaved hymenopappus	1	B
3420	Hymenoxys acaulis/acaulis	Stemless hymenoxys	1,3,4	A,B
3430	Hymenoxys richardsonii/richardsonii	Richardson's hymenoxys	1	B
3435	Hypericum formosum	Western St. John's-wort	6	
3440	Iliamna rivularis/rivularis	Streambank globemallow	1,2	B,C
3450	Iris missouriensis	Rocky Mountain iris	1,2,3,4	A,B,C
3455	Iva axillaris	Poverty weed	2	C
3460	Ivesia gordonii	Gordon's ivesia		A
3470	Kelseya uniflora	Kelseya		A
3480	Lactuca pulchella	Blue lettuce	1	B
3490	Lactuca serriola	Prickly lettuce	1	B
3500	Lappula redowskii/redowskii	Western stickseed	1	B
3510	Lathyrus ochroleucus	Cream-flowered peavine	1,2	B,C
3515	Lathyrus spp.	Genera		
3518	Leguminosae	Family		
3520	Lepidium campestre	Field pepperweed	1	B
3530	Lesquerella alpina	Alpine bladderpod	1,3,4	A,B
3540	Liatrus punctata	Blazing-star	1,3,4	A,B
3545	Ligusticum spp.	Licorice root		
3546	Ligusticum verticillatum	Verticillate-umbel lovage		
3550	Lilium philadelphicum	Wood lily	2,3	A,C
3555	Limosella aquatica	Mudwort	2	C
3560	Linum perenne/lewisii	Wild blue flax	1,3,4,6	A,B
3570	Linum rigidum	Yellow flax	1	B
3580	Lithospermum ruderale	Western gromwell	1,3,4,6	A,B
3585	Lobelia kalmii	Bog lobelia	2	C
3590	Lomatium cous	Cous biscuit-root	6	
3600	Lomatium dissectum/multifidum	Fern-leaved lomatium	1,3,6	A,B
3610	Lomatium macrocarpum	Large-leaved lomatium	1,3,4	A,B
3620	Lomatium triternatum spp. platycarpum	Nine-leaf lomatium	1,6	A,B

Plant No.	Scientific binomial	Common name	Source	Plant Collection
3625	Lomatium spp.	Genera		
3630	Lupinus sericeus/sericeus	Silky lupine	1,3,4	A,B
3640	Lychnis apetala	Apet campion		
3650	Lysimachia ciliata	Fringed loosestrife	2	C
3655	Lysimachia thrysiflora	Tufted loosestrife	2	C
3660	Madia spp.		Tarweed	
3670	Medicago lupulina	Black medic	1,2	B,C
3680	Medicago sativa	Alfalfa	1	B
3690	Melilotus alba	White sweet-clover	1	B
3700	Melilotus officinalis	Yellow sweet-clover	1,2,3,4	A,B,C
3710	Mentha arvensis/glabrata	Field mint	1,2	B,C
3720	Mentzelia laevicaulis/laevicaulis	Blazing-star mentzelia	1	B
3725	Menyanthes trifoliata	Bogbean	2	C
3730	Mertensia ciliata/ciliata	Broad-leaf bluebells		
3733	Mertensia longiflora	Small bluebells	6	
3735	Mertensia oblongifolia	Leafy bluebells	6	
3740	Microseris cuspidata	Toothed microseris		A
3750	Microseris spp.	Genera		
3760	Mimulus guttatus/guttatus	Yellow monkey-flower	1	B
3765	Mitella breweri	Brewer's mitrewort	6	
3770	Monarada fistulosa/menthifolia	Horse mint	1,2,3,4	A,B,C
3780	Monolepis nuttalliana	Patata	1,2	B,C
3790	Musineon divaricatum	Leafy musineon	1,4	B
3792	Myosotis arvensis	Forget-me-not	2	C
3795	Myosotis sylvatica	Wood forget-me-not	6	
3797	Myosurus minimus	Mouse-tail	2	C
3800	Myriophyllum spicatum/exalbescens	Spiked water-milfoil	1,2	B,C
3805	Navarretia intertexta	Neddle-leaf navarretia	2	C
3810	Oenothera caespitosa/caespitosa	Desert evening-primrose	1	B
3820	Oenothera flava	Long-tubed evening-primrose	1	B
3830	Oenothera strigosa	Common evening-primrose	1,2	B,C
3840	Onobrychis viciaefolia	Saintfoin	1	B
3845	Onosmodium molle	False groomwell	2	C
3850	Opuntia polyacantha	Prickly-pear cactus	1,3,4	A,B
3860	Orthocarpus luteus	Yellow owl-clover	3,4	A
3865	Orthocarpus tenuifolius	Thin-leaved owl-clover		
3870	Osmorhiza chilensis	Mountain sweet-cicely	1,2	B,C
3875	Osmorhiza depauperata	Blunt-fruited sweet-cicely	2	C
3880	Osmorhiza occidentalis	Western sweet-cicely	1,2,6	B,C
3890	Osmorhiza spp.	Genera		

Plant No.	Scientific binomial	Common name	Source	Plant Collection
3895	Oxytropis bessayi	Bessey's crazyweed		
3900	Oxytropis campestris/gracilis	Field crazyweed	1	B
3905	Oxytropis deflexa	Pendant-pod crazyweed	2	C
3910	Oxytropis lagopus	Rabbit-foot crazyweed		
3920	Oxytropis sericea/spicata	Silky crazyweed	1,3,4,6	A,B
3030	Oxytropis splendens	Showy crazyweed	1,3,4	A,B
3940	Oxytropis viscida	Sticky crazyweed	1,3,4	A,B
3942	Oxytropis spp.	Genera		
3945	Pachistima myrsinites	Myrtle boxwood		A
3950	Parnassia fimbriata/fimbriata	Fringed grass-of-parnassus	1,6	B
3960	Parnassia palustris	Northern grass-of-parnassus	2	A,C
3970	Paronychia sessiliflora	Whitlow wort	1,3,4	A,B
3975	Pastinaca sativa	Parsnip	2	C
3980	Pedicularis bracteosa	Bracted lousewort	6	A
3990	Pedicularis contorta/contorta	White coiled-beak lousewort	1,3,5,6	A,B
4000	Pedicularis groenlandica	Elephant's head	6	A
4010	Pedicularis racemosa	Stickletop lousewort		A
4020	Pedicularis spp.	Genera		
4030	Penstemon albertinus	Alberta penstemon	1,3	A,B
4035	Penstemon attenuatus	Sulphur penstemon	6	
4040	Penstemon confertus	Yellow penstemon	1,3,4,5	A,B
4050	Penstemon ellipticus	Elliptic-leaved penstemon	5	
4060	Penstemon eriantherus/eriantherus	Fuzzy tongue penstemon	1,3,4,6	A,B
4065	Penstemon fruticosus	Shrubby penstemon	6	
4067	Penstemon lyallii	Lyall's beard tongue	6	
4070	Penstemon nitidus/nitidus	Shining penstemon	1,6	B
4080	Penstemon procerus/procerus	Small-flowered penstemon	1,2	B,C
4090	Penstemon spp.	Genera		
4100	Perideridia gairdneri ssp. borealis	Garidner's yampah	1,3,4	A,B
4110	Petalostemon candidum	White prairie-clover	1,4	B
4120	Petalostemon purpureum	Purple prairie-clover	1,3,4	A,B
4130	Phacelia sericea	Silky phacelia		A
4140	Phacelia hastata/alpina	Virgate phacelia	1,5,6	B
4150	Phacelia linearis	Threadleaf phacelia	3,4	A
4152	Phacelia lyalli	Lyall's phacelia		
4155	Phlox albomarginata	White-margined phlox	6	
4160	Phlox alyssifolia	Alyssum-leaved phlox	1,3,4	A,B
4170	Phlox hoodii	Hood's phlox	3,4	A
4175	Phlox kelseyi	Kelsey's phlox	2	C
4178	Phlox spp.		Genera	

Plant No.	Scientific binomial	Common name	Source	Plant Collection
4180	Physaria didymocarpa	Common twinpod	1,5,6	B
4185	Plagiobothrys scouleri	Popcorn-flower	2	C
4190	Plantago eriopoda	Alkali plantain	2	C
4195	Plantago major/major	Common plantain	1,2	B,C
4198	Polemonium occidentale	Western polemonium	6	
4200	Polemonium pulcherrimum	Showy polemonium	6	A
4210	Polygonum achoreum	Striated knotweed	1	B
4220	Polygonum amphibium	Water smartweed	1,2	B,C
4225	Polygonum aviculare	Doorweed	2	C
4230	Polygonum bistortoides	American bistort	1,3,6	A,B
4232	Polygonum convolvulus	Black bindweed	2	C
4235	Polygonum kelloggii	Kellog's knotweed	2	C
4236	Potamogeton crispus	Curled pondweed	2	C
4237	Potamogeton filiformis	Slender-leaved pondweed	2	C
4238	Potamogeton nodosus	Long-leaved pondweed	2	C
4239	Potamogeton pectinatus	Fennel-leaved pondweed	2	C
4240	Potentilla anserina	Common silverweed	1,2	B,C
4250	Potentilla arguta/convallaria	Glandular cinquefoil	1	A,B
4260	Potentilla diversifolia/ diversifolia	Diverse-leaved cinquefoil	1,6	B
4270	Potentilla glandulosa	Sticky cinquefoil	1	A,B
4280	Potentilla gracilis/glabrata	Slender cinquefoil	2,3,4,6	A,C
4281	Potentilla gracilis/flabelliformis	Slender cinquefoil	2,3,4	A,C
4290	Potentilla hippiana	Woolly cinquefoil	1,3,4	A,B
4300	Potentilla ovina	Sheep cinquefoil	6	
4310	Potentilla pensylvanica	Prairie cinquefoil	1	B
4320	Potentilla rivalis	River cinquefoil	1,2	B,C
4325	Potentilla uniflora	One-flower cinquefoil	5	
4330	Potentilla spp.	Genera		
4331	Primula incana	Mealy primrose	2	C
4335	Prunella vulgaris	Self-heal	2	C
4331	Pyrola asarifolia	Pink wintergreen	2	C
4340	Pyrola chlorantha	Wintergreen		A
4345	Phrola minor	Snowline wintergreen		
4350	Pyrola secunda	One-sided wintergreen		A
4360	Pyrola uniflora	Wax-flower		A
4370	Pyrola spp.	Genera		
4380	Ranunculus acriformis/montanensis	Sharp buttercup	1	B
4390	Ranunculus aquatilis/capillaceus	White water-buttercup	1,2	B,C
4400	Ranunculus cymbalaria	Shore buttercup	1,2	B,C

Plant No.	Scientific binomial	Common name	Source	Plant Collection
4410	Ranunculus eschscholtzii	Subalpine buttercup	6	A
4415	Ranunculus flammula	Creeping buttercup	2	C
4416	Ranunculus glabberimus	Sagebrush buttercup	6	
4417	Ranunculus gmelinii	Gmelin's buttercup	2	C
4420	Ranunculus macounii/macounii	Macoun's buttercup	1,2	B,C
4430	Ranunculus orthorhynchus	Straightbeak buttercup	1	B
4440	Ranunculus sceleratus/multifidus	Celeryleaved buttercup	1,2	B,C
4450	Ranunculus spp.	Genera		
4460	Ratibida columnifera	Prairie coneflower	1	B
4465	Rorippa islandica	Marsh yellowcress	2	C
4470	Rudbeckia laciniata/ampla	Tall coneflower	1,2	B,C
4480	Rumex crispus	Curly dock	1,2	B,C
4485	Rumex salicifolius	Willow dock	2	C
4490	Ruppia maritima	Seaside arrowgrass	1	B
4500	Sagittaria cuneata	Arrowhead	2	C
4505	Salsola kali	Russian thistle	1	B
4510	Sanicula marilandica	Black snake-root	1,2	A,B,C
4520	Saxifraga bronchialis/austromontana	Spotted saxifrage	1,6	B
4523	Saxifraga oppositifolia	Purple saxifrage	6	
4525	Saxifraga rhomboidea	Diamond-leaved saxifrage	6	
4530	Sedum lanceolatum/lanceolatum	Lance leaved stonecrop	1,3,4,6	A,B
4535	Sedum roseum	Roseroot	6	
4540	Sedum stenopetalum	Wormleaf stonecrop		A
4550	Sedum spp.	Genera		
4560	Senecio canus	Woolly groundsel	1,4	B
4570	Senecio fremontii	Dwarf mountain butterweed		A
4580	Senecio indecorus	Rayless mountain butterweed		
4581	Senecio integerrimus	Western groundsel	6	
4590	Senecio megacephalus	Large-headed butterweed		A
4600	Senecio pauperculus	Balsam goundsel	2	A,C
4610	Senecio pseudaureus/pseudaureus	Streambank butterweed	1	B
4615	Senecio resedifolius	Dwarf arctic butterweed	6	
4620	Senecio serra/serra	Butterweed groundsel	1,2	B,C
4630	Senecio spp.	Genera		
4640	Senecio triangularis/trianyularis	Arrowleaf groundsel	1,6	A,B
4642	Sibbaldia procumbens	Sibbaldia	6	
4643	Silene acaulis	Moss campion	6	
4645	Silene menziesii	Silene	2	C
4650	Sisymbrium altissimum	Tumblemustard	1	B

Plant No.	Scientific binomial	Common name	Source	Plant Collection
4660	Sisyrinchium angustifolium	Common blue-eyed grass	1,2	A,B,C
4665	Smelowskia calycina	Alpine smelowskia	6	
4670	Smilacina racemosa	Feather solomon's seal	1,2,3,4,6	A,B,C
4680	Smilacina stellata	Starry false solomon's seal	1,2	A,B,C
4690	Solidago canadensis/salebrosa	Canada goldenrod	1,2	B,C
4700	Solidago gigantea/serotina	Smooth goldenrod	1,2	B,C
4710	Solidago missouriensis/ missouriensis	Missouri goldenrod	1,3,4	A,B
4720	Solidago multiradiata	Northern goldenrod	5,6	
4725	Solidago Nemoralis	Gray goldenrod	2	C
4730	Solidago rigida/humilis	Stiff goldenrod	1	B
4737	Solidago spathulata	Dune goldenrod	6	
4740	Solidago spp.	Genera		
4750	Sonchus asper	Prickly sow-thistle	1	A,B,
4752	Sonchus uliginosus	Sow-thistle	2	C
4755	Sparganium emersum	Simple stem bur-reed	2	C
4757	Sparganium minimum	Small bur-reed	2	C
4760	Sphaeralcea coccinea	Red globe-mallow	1	B
4770	Spiranthes romanzoffiana	Ladies-tresses	2	A,C
4780	Stachys palustris/pilosa	Swamp hedge-nettle	1,2	B,C
4785	Stellaria longifolia	Longleaved starwort	2	C
4786	Stellaria media	Chickweed	2	C
4790	Streptopus amplexifolius/chalazatus	Large twisted-stalk	1,2	B,C
4798	Taraxacum laevigatum	Red-seeded dandelion	2	C
4800	Taraxacum officinale	Common dandelion	1,2,3,4,6	A,B,C
4810	Taraxacum spp.	Genera		
4820	Thalictrum occidentale	Western meadowrue	1,2,3,4,6	A,B,C
4823	Thalictrum venulosum	Veiny meadowrue	2	C
4830	Thelesperma subnudum/marginatum	Thelesperma	2,3,4	A,B
4840	Thermopsis montana	Mountain thermopsis		
4850	Thermopsis rhombifolia	Round-leaved thermopsis	1,3,4	A,B
4860	Thlaspi arvense	Field pennycress	1,2	B,C
4870	Townsendia montana	Mountain townsendia		A
4880	Townsendia parryi	Parry's townsendia	1,6	B
4890	Tragopogon dubius	Yellow salsify	1,3,4	A,B
4895	Trifolium hybridum	Alsike clover	3	A
4898	Trifolium longipes	Long-stalked clover	2	C
4900	Trifolium pratense	Red clover	1,2,3,4	A,B,C
4910	Trifolium repens	White clover	1,2,3,4	A,B,C
4915	Trifolium spp.	Genera		

Plant No.	Scientific binomial	Common name	Source	Plant Collection
4920	Triglochin maritimum	Seaside arrow-grass	1,2,3,4	A,B,C
4925	Triglochin palustre	Marsh arrow-grass	2	C
4930	Trillium ovatum	Western wake-robin		
4950	Urtica dioica ssp. gracilis/ gracilis	Slim nettle	1,2	B,C
4960	Urtica dioica ssp. gracilis/procera	Stinging nettle	1,2	B,C
4965	Utricularia minor	Lessor bladderwort	2	C
4968	Utricularia vulgaris	Common bladderwort	2	C
4970	Unknown forb			
4980	Valeriana dioica	Northern valerian	2	A,C
4990	Valeriana edulis	Edible valerian	2	C
4995	Valeriana occidentalis	Western valerian		
5000	Valeriana sitchensis	Sitka valerian	6	A
5010	Valeriana spp.	Genera		
5020	Veratrum viride	Green false hellebore	6	A
5030	Verbena bracteata	Bracted verbena	1	B
5040	Veronica americana	American brookline	1,2	B,C
5043	Veronica catenata	Chain speedwell	2	C
5044	Veronica cusickii	Cusick's speedwell	6	
5047	Veronica peregrina	Purslane speedwell	2	C
5050	Vicia americana/truncata	American vetch	1,2,3,4	A,B,C
5060	Vicia sativa	Common vetch		
5065	Vicia spp.		Genera	
5068	Viola adunca	Early blue violet	2	A,C
5070	Viola canadensis/rugulosa	Western Canada violet	1,2,3	A,B,C
5080	Viola glabella	Stream violet		A
5085	Viola nephrophylla	Bog violet	2	C
5090	Viola orbiculata	Round-leaved violet		
5100	Viola spp.		Genera	
5110	Xanthium strumarium	Common cocklebur		
5115	Xerophyllum tenax	Beargrass		
5120	Zigadenus elegans	Mountain death-camas	1,2,3,4,5	A,B,C
5130	Zigadenus venenosus/gramineus	Meadow death-camas	1,3,4,6	A,B
5140	Zizia aptera/occidentalis	Zizia	1	B
5150	Total forbs			
5990	Moss			
6000	Mineral Soil			
6010	Rock			

8072/2

Appendix C. Grizzly bears captured on the East Front, 1977-1986.

DATE OF CAPTURE	NO.	SEX	AGE (1986)	LOCATION	EAR TAG (TYPE)	FATE
5/04/77	257	F	17½	Blackleaf	Orange/Yellow (metal)	Recaptured & radioed 6/13/80. Recaptured & radioed w/ helicopter in August, 1982.
5/07/77	110	F	2½*	Blackleaf	Red/Yellow (metal)	Recaptured 6/9/77, relocated, dead 1977.
5/25/77	271	M	7½*	Teton River	Blue/Yellow (metal)	Recaptured 5/20/78 & 5/9/79. Poached 1979.
6/08/77	273	F	10½*	Teton River	Yellow (metal)	Recaptured 5/16/81 & radioed. Illegally killed 9/23/84.
5/20/78	218	M	16½	Teton River	Blue/Red (metal)	Radio nonfunctional, possibly alive.
5/29/78	531	M	10½	Blackleaf	Silver/Orange (metal)	Relocated 1978 to Flathead.
6/16/78	282	M	8½*	Elk Cr.	Red (metal) & Green(rototag)	Recaptured & radioed 5/4/83. Hunter-kill 10/24/84.
6/17/78	229	M	10½*	Elk Cr./ Dearborn	Blue/Yellow (metal)	Hunter-kill 1979.
5/17/79	332	M	23½	Elk Cr.	Red/Yellow (metal)	Relocated to British Columbia.
5/20/79	220	F	25½	Teton area	Yellow/Blue (metal)	Recaptured 6/8/79 & 4/29/81 & reradioed w/helicopter in May 1983. Slipped collar at den site, winter 1984.
5/22/79	333	M	8½	Blackleaf to Badger Cr.	Blue/Yellow (metal)	Recaptured 6/10/80 & 4/21/81. Lost collar in August 1982.
5/23/79	203	M	8½	Teton area	Orange/Green (metal)	Sighted in 1981.
7/27/79	347	M	5½*	Dearborn area		Killed in 1980 by sheepherder.
5/14/80	348	M	4½*	Blackleaf	Silver/Red (metal)	Killed in 1980 by USFWS near Lincoln, Montana.
5/20/80	335	F	8½	Blackleaf to Birch Cr.	Red/Orange (metal)	Recaptured 5/29/81 & radioed. Radio malfunctioned May 1984. Recaptured, radioed, & relocated, preventative action, to Elk Cr. 9/13/85.
6/10/80	291	F	9½	Blackleaf	Red/Green (metal)	Fate unknown, radio nonfunctional.
8/14/80	223	M	11½	Blackleaf to Badger Cr.	Yellow/Blue (metal)	Fate unknown, radio nonfunctional.
8/0?/80	430	F	2½*	Badger Cr.		Relocated & dead in 1980.
5/20/82	529	M	2½*	Teton to Sun River	Blue (rototag)	Recaptured & radioed 5/25/82. Hunter-kill 1982, at N. Fk. Sun River.
5/26/82	550	M	3½*	Blackleaf to Two Medicine	Blue (rototag)	Lost collar in July, 1982. Hunter-kill Sept. 1983, after relocation.
6/18/82	518	F	3½*	Teton to Deep Cr.	Red (rototag)	Ear-tag transmitter. Recaptured in 1983. Hunter-kill 10/21/84.

* = age at death

Appendix C. Grizzly bears captured on the East Front, 1977-1986.

DATE OF CAPTURE	NO.	SEX	AGE (1986)	LOCATION	EAR TAG (TYPE)	FATE
6/27/82	519	M	1½*	Teton area	Blue (rototag)	Hunter-kill 1982 at Teton River.
6/28/82	544	M	4½*	Teton area	Blue (rototag)	Radioed in 1982, still functional. Recaptured 1984, Killed illegally Sept. 1984.
8/17/82	548	F	14½	Deep Cr.	Blue (rototag)	Captured & radioed w/helicopter, recaptured in 1983. Radio malfunctioned.
5/03/83	522	F	4½	Pine Butte	Red (rototag)	Unknown
5/27/83	524	F	4½	Rinkers Cr.	Red (rototag)	Radioed w/ear-tag transmitter; 1983. Radio malfunctioned.
5/31/83	500 499	F	7½	Teton River	Green (rototag)	Radioed. Helicopter darted, recaptured, radioed at depredation site 6/11/85, relocated to S. Fk. Flathead. Helicopter darted, recaptured at depredation site 6/29/85, relocated to E. side of Mission Mtns., returned.
6/10/83	498 497	M	7½	Willow Cr.	Green (rototag)	Radio malfunction spring 1985. Recaptured 6/23/86, trap/drug caused mortality.
7/10/83	485 484	M	10½	Whiterock Creek	Green (rototag)	Radioed. Recaptured 6/26/84. Collar slipped approx. 7/1/85.
4/06/84	328	M	4½	Teton	Green (rototag)	Radioed, recaptured 5/19/84.
6/20/84	313	F	5½	Two Medicine	Green (rototag)	Radioed, still operate 1985.
6/26/84	366	F	7½	Two Medicine	Green (rototag)	Recaptured 7/6/86 and radioed.
7/06/84	355	M	8½	Two Medicine	Green (rototag)	Recaptured 5/23/86, 5/27/86, 6/21/86. Slipped collar 8/86.
8/23/84	378	M	4½	Teton	Green (rototag)	Helicopter darted, radioed, recaptured 9/27/84 at depredation site relocated to S. Fk. Flathead.
9/10/84	317	F	5½	Teton	Green (rototag)	Radioed, still operate 1985.
9/18/84	372	F	8½*	Alice Cr.	Green (rototag)	Radioed, relocated to S. Fk. Flathead - dead Oct. 1984 at Burdoff Cr. cause of death unknown.
9/18/84	343	M	1½*	Alice Cr./ Willow Cr.	Green (rototag)	Helicopter darted cub of 372 recaptured, radioed, at depredation site 6/29/85; capture mortality.
9/25/84	392	M	4½	Teton	Green (rototag)	Radioed, still operate 1985.

* = age at death

Appendix C. Grizzly bears captured on the East Front, 1977-1986.

DATE OF CAPTURE	NO.	SEX	AGE (1986)	LOCATION	EAR TAG (TYPE)	FATE
10/02/84	326	M	3½	Teton/Middle Fk. Dearborn	Green (rototag)	Radioed, collar slipped in November 1984. Recaptured & radioed 4/4/85. Recaptured & relocated, livestock depredation 8/3/85. Illegally killed.
5/11/85	316	F	4½	Cuniff Cr.	Green (rototag)	Radioed, recaptured 5/14/85.
5/18/85	342	M	3½	Fairfield Bench	Green (rototag)	Radioed & relocated, preventative action, to Middle Fk. Flathead. Recaptured at depredation site 6/1/85, transported to zoo, Mexico City.
5/23/85	346	M	7½	Cuniff Cr.	Green (rototag)	Radioed. Collar slipped early Oct., 1985.
6/11/85	---	M	1½*	Deep Cr.	---	Helicopter darted at depredation site, capture mortality. Cub of 500 unmarked
6/11/85	338	M	2½	Deep Cr.	Green (rototag)	Helicopter darted at depredation site, relocated to So. Fk. Flathead. Helicopter darted & recaptured at depredation site 6/29/85, relocated to E. side of Mission Mtns. returned. Cub of 500
6/11/85	341	F	2½	Deep Cr.	Green (rototag)	Helicopter darted at depredation site, relocated to So. Fk. Flathead. Helicopter darted & recaptured at depredation site 6/29/85, relocated to E. side of Mission Mtns. returned. Recaptured at depredation site 5/14/86, transported to zoo, Detroit. Cub of 500.
6/17/85	301	F	13½	Moudess Cr.	Green (rototag)	Radioed.
9/13/85	306	M	2½	Dupuyer Cr.	Green (rototag)	Radioed & relocated, preventative action, to S. Fk. Flathead. Returned. Illegally killed late Oct., early Nov., 1985. Cub of 335
9/13/85	381	M	2½	Dupuyer Cr.	Green (rototag)	Radioed & relocated, preventative action, to S. Fk. Flathead. Cub of 335
9/13/85	312	F	3½	Teton River	Green (rototag)	Radioed & relocated, preventative action, to Sun River Game Range. Returned.

* = age at death

Appendix C. Grizzly bears captured on the East Front, 1977-1986.

DATE OF CAPTURE	NO.	SEX	AGE (1986)	LOCATION	EAR TAG (TYPE)	FATE
5/16/86	101	F	3½*	Ford Cr.	Green (rototag)	Radioed, relocated, preventive action, killed illegally 1986.
5/20/86	410	M	3½	Smith Cr.	Green (rototag)	Died of natural mortality 5/20/86.
5/21/86	412	M	7½	Petty Cr.	Green (rototag)	Radioed. Slipped collar 7/86.
6/28/86	464	F	Cub	Badger Cr.	Green (rototag)	Cub of 466.
6/28/86	466	F	15½	Badger Cr.	Green (rototag)	Radioed.
7/6/86	467	M	3½	Elbow Cr.	Green (rototag)	Radioed, recaptured 7/9/86.
10/9/86	106	M	4½*	Teton area	Green (rototag)	Captured at depredation site and relocated. Illegally killed 10/86.

* = age at death

8072/2

Appendix D. Black bears captured on the East Front, 1976-1986.

DATE OF CAPTURE	NO.	SEX	AGE (1986)	LOCATION	EAR TAG (TYPE)	COLOR	FATE
9/15/76	190	F	16	Badger Cr.	Blue/Green (metal)	Black	Recaptured 6/27/77.
9/20/76	153	F	Adult	Badger Cr.	Red/Green (metal)	Black	Recaptured 10/16/76.
10/01/76	150	M	Adult	Badger Cr.	Red/Blue (metal)	Black	Unknown.
10/02/76	2	M	Adult	Badger Cr.	Yellow (metal)	Black	Unknown.
10/07/76	3	M	12	Badger Cr.	Yellow (metal)	Brown	Unknown.
4/30/77	117	M	14	Dupuyer Cr.	Yellow/Blue (metal)	Black	Recaptured 5/3/77.
5/09/77	173	M	12	Dupuyer Cr.	Yellow/Blue (metal)	Black	Unknown.
5/09/77	262	M	18	Dupuyer Cr.	Yellow/Orange (metal)	Brown	Recaptured 6/3/78.
5/22/77	207	F	11	Teton River	Blue/Orange (metal)	Brown	Unknown.
5/23/77	201	M	5½*	Teton River	Orange (metal)	Black	Hunter-kill 1980.
5/27/77	265	M	7½*	Teton River	Blue/Yellow (metal)	Brown	Recaptured 5/10/78. Hunter-kill 1980.
6/05/77	274	M	11	Teton River	Yellow/Blue (metal)	Black	Unknown.
6/08/77	209	F	22+	Teton River	Orange/Silver (metal)	Brown	Unknown.
6/19/77	213	M	11	Badger Cr.	Blue/Green (metal)	Black	Unknown.
6/25/77	219	M	17	Badger Cr.	Blue/Green (metal)	Black	Recaptured 6/28/77.
6/26/77	204	M	12	Badger Cr.	Orange/Silver (metal)	Black	Unknown.
5/10/78	256	M	6½*	Teton River	Orange/Red (metal)	Brown	Hunter-kill 6/3/79.
5/12/78	211	M	19	Teton River	Yellow/Orange (metal)	Black	Relocated to Blackleaf 8/21/80.
6/06/78	212	M	7½*	Blackleaf	Blue/Red (metal)	Black	Recaptured 9/25/80 & 6/23/81 & radioed. Recaptured 5/24/82. Hunter-kill 7/11/82.
6/13/78	202	M	15*	Elk Cr.	Orange/Blue (metal)	Brown	Recaptured 5/2/84 @ Elk Cr. Hunter-kill 9/25/86.
6/14/78	205	M	Adult	Elk Cr.	Orange/Red (metal)	Black	Unknown.
5/20/79	288	M	17	Blackleaf	Green/Red (metal)	Brown	Recaptured 5/10/80 & 6/29/82 & radioed. Radio off Sept. 1982.

* = age at death

Appendix D. Black bears captured on the East Front, 1976-1986, (continued).

DATE OF CAPTURE	NO.	SEX	AGE (1986)	LOCATION	EAR TAG (TYPE)	COLOR	FATE
5/28/79	255	F	10	Teton River	Orange/Silver (metal)	Brown	Recaptured 5/16/82.
6/09/79	115	M	14	Teton River	Yellow/Green (metal)	Brown	Unknown.
6/09/79	294	M	9½*	Teton River	Green/Orange (metal)	Black	Recaptured 5/23/82. Hunter-kill 5/23/82.
5/19/80	329	M	5½*	Blackleaf	Yellow/Red (metal)	Black	Hunter-kill 8/6/80 @ Cave Mtn.
5/21/80	223	M	9	Blackleaf	Blue (rototag)	Brown	Unknown.
5/28/80	538	M	5½*	Blackleaf	Blue (rototag)	Brown	Hunter-kill June 83 @ Ford Cr.
5/30/80	505	M	8	Blackleaf	Red (rototag)	Black	Recaptured 9/1/80.
6/07/80	542	M	5½*	Blackleaf	Blue (rototag)	Black	Hunter-kill 10/28/82 @ Green Timber Gulch.
6/09/80	509	F	15	Blackleaf	Red (rototag)	Black	Recaptured 5/14/81 & radioed; observed 8/22/84.
5/20/81	545	F	8	Blackleaf	Blue (rototag)	Black	Recaptured 5/21/81.
5/23/81	546	F	8	Blackleaf	Blue (rototag)	Brown	Unknown.
5/27/81	516	M	8	Blackleaf	Red (rototag)	Brown	Unknown.
5/02/82	539	M	4½*	Teton River	Blue (rototag)	Brown	Hunter-kill 11/3/83 Patricks Basin.
5/17/82	513	M	6	Teton River	Red (rototag)	Brown	Recaptured 6/19/83, 5/17/84 at Sun River Game Range.
5/17/82	514	M	2½*	Teton River	Red (rototag)	Brown	Recaptured 6/26/82. Hunter-kill 10/2/82 @ Jones Cr.
5/22/82	531	F	8*	Dupuyer Cr.	Blue (rototag)	Black	Hunter kill 9/28/86.
6/19/82	523	F	9	Teton River	Red (rototag)	Black	Radioed until 5/25/84 when collar was cast.
6/24/82	517	M	7½*	Teton River	Red (rototag)	Black	Radioed. Recaptured May, 1983, collar dead. Hunter-kill 5/18/85 @ Reirdon Gulch.
7/12/82	533	F	10½*	Badger Cr.	Blue (rototag)	Brown	Hunter-kill 10/19/83 @ Badger Cr.

* = age at death

Appendix D. Black bears captured on the East Front, 1976-1986, (continued).

DATE OF CAPTURE	NO.	SEX	AGE (1986)	LOCATION	EAR TAG (TYPE)	COLOR	FATE
4/30/83	530 354	M	9*	Blubber Cr.	Blue/Green (rototag)	Brown	Recaptured 5/27/83, 5/4/84, renumbered 354 on 6/3/84, recaptured 5/17/86. Hunter-kill 5/25/86.
4/30/83	535 365	M	6	Blubber Cr.	Blue/Green (rototag)	Black	Recaptured 6/17/83, renumbered 365 on 5/12/8[illegible]. Hunter-kill 5/15/85.
5/18/83	536	M	11	Blubber Cr.	Blue (rototag)	Black	Recaptured 5/27/83 & 6/15/83, 5/12/84.
5/19/83	506	M	5½*	Pine Butte	Red (rototag)	Black	Radioed. Hunter-kill Sep[illegible]. 1984 @ Jones Creek.
5/24/83	515	M	6½*	Rinkers Cr.	Red (rototag)	Black	Radioed until 5/11/84, collar dead. Hunter-kill 8/11/85 @ Jones Cr.
5/27/83	537	M	4½*	Blubber Cr.	Blue (rototag)	Black	Unknown.
6/11/83	532	M	5½*	Willow Cr.	Blue (rototag)	Black	Hunter-kill 5/21/84 @ Ford Cr.
6/12/83	525	F	7	Blubber Cr.	Red (rototag)	Black	Recaptured 5/25/86.
6/13/83	534	M	6	Sun River Game Range	Blue (rototag)	Black	Recaptured 6/27/83, 5/11/84.
6/16/83	478	M	6*	Sun River Game Range	Green (rototag)	Black	Probably hunter killed 5/21/86, tatoo id.?
6/17/83	479	F	4	Beaver Cr.	Green (rototag)	Black	Unknown.
[1]6/18/83	520	M	5	Blubber Cr.	Red (rototag)	Black	Unknown.
6/20/83	507	M	4	Blubber Cr.	Red (rototag)	Black	Recaptured 6/22/83, 5/17/84.
6/21/83	477/ 409	F	13	Willow Cr.	Green (rototag)	Brown	Recaptured 5/21/86 & renumbered 409.
6/25/83	491	F	5	Beaver Cr.	Green (rototag)	Black	Unknown.
6/25/83	492	M	7½*	Beaver Cr.	Green (rototag)	Brown	Hunter-kill 5/27/85 @ Farview Cr.
6/27/83	494	F	3	Rose Cr.	Green (rototag)	Black	Unknown.
6/27/83	476	M	6	Willow Cr.	Green (rototag)	Black	Unknown.
[1]7/12/83	520	M	6	N. Fk. Badger Cr.	Red (rototag)	Cinnamon	Recaptured 5/26/86.
7/12/83	547	M	6*	Whiterock	Blue (rototag)	Black	Recaptured 6/4/84. Hunter-kill September 1984 @ Badger Cr.
8/05/83	401/ 426	F	7	S. Fk. Teton	Green (rototag)	Black	Nuisance bear captured @ Circle 8. Nuisance bear recaptured 8/30/86, renumbered 426.

* = age at death

[1] Two black bears inadvertantly #'d the same - one is cinnamon and one is black.

Appendix D. Black bears captured on the East Front, 1976-86, (continued).

DATE OF CAPTURE	NO.	SEX	AGE (1986)	LOCATION	EAR TAG (TYPE)	COLOR	FATE
5/02/84	327/ 418	M	12	Willow Cr.	Green (rototag)	Brown	Recaptured 5/23/84, renumbered 418 on 6/27/86.
5/05/84	352	M	9*	Beaver Cr.	Green (rototag)	Black	Recaptured 5/12/84 at Middle Fk. Beaver Ck. Hunter-kill 5/20/86.
5/07/84	455	M	4	Blubber Cr.	Green (rototag)	Cinnamon	Recaptured 5/28/84 Goss Ck.
5/08/84	353	M	4*	Beaver Cr.	Green (rototag)	Cinnamon	Hunter-kill 5/22/86.
5/08/84	475	M	9	Elk Cr.	Green (rototag)	Black	Recaptured 5/11/84 at Sawmill Pass.
5/10/84	364	F	4	Sun River Game Range	Green (rototag)	Brown	Unknown.
5/10/84	339	M	11	Ford Cr.	Green (rototag)	Brown	Unknown.
5/10/84	344	M	3	Beaver Cr.	Green (rototag)	Blonde	Unknown.
5/12/84	332	M	4	Blubber Cr.	Green (rototag)	Cinnamon	Recaptured 5/18/84 at Sawmill Pass and 6/10/84 at Blubber Cr.
5/13/84	375	M	16	Sun River Game Range	Green (rototag)	Black	Unknown.
5/14/84	331	F	7	Willow Cr.	Green (rototag)	Brown	Recaptured 5/18/84 & 5/16/86.
5/18/84	495	M	4*	Elk Cr.	Green (rototag)	Black	Hunter-kill 5/26/86.
5/19/84	388	M	2½*	Smith Cr.	Green (rototag)	Brown	Hunter-kill in October 1984 @ Elk Creek.
5/22/84	380	F	21½*	Shed Cr.	Green (rototag)	Cinnamon	Hunter-kill 6/1/85 @ Sun River Game Range.
5/22/84	387	M	3	Shed Cr.	Green (rototag)	Black	Unknown.
5/23/84	389	F	4	Beaver Cr.	Green (rototag)	Black	Unknown.
5/26/84	393	M	9½*	Elk Cr.	Green (rototag)	Black	Hunter-kill August 1984 @ Elk Cr.
6/02/84	383	M	5	Blubber Cr.	Green (rototag)	Black	Recaptured 6/4/84 at Sawmill Cr. and 6/13/84 at Goss Cr. Hunter-kill 10/15/86
6/03/84	399	M	4½*	Elk Cr.	Green (rototag)	Brown	Hunter-kill 10/19/84 @ Bighorn Lake.
6/04/84	318	M	4	Gross Cr.	Green (rototag)	Black	Unknown.
6/05/84	360	M	4	Hyde Cr.	Green (rototag)	Black	Unknown.
6/07/84	356	F	4	Mettler Coulee	Green (rototag)	Black	Recaptured 5/29/86.
6/09/84	345	F	6*	Cyanide Cr.	Green (rototag)	Blonde	Hunter-kill 9/27/86.

* = age at death

Appendix D. Black bears captured on the East Front, 1976-86, (continued).

DATE OF CAPTURE	NO.	SEX	AGE (1986)	LOCATION	EAR TAG (TYPE)	COLOR	FATE
6/11/84	336	F	10	Mettler Coulee	Green (rototag)	Black	Unknown.
6/19/84	322	M	7	Mettler Coulee	Green (rototag)	Cinnamon	Unknown.
6/19/84	386	F	4	Hyde Cr.	Green (rototag)	Black	Unknown.
6/24/84	349	M	15	Hyde Cr.	Green (rototag)	Black	Unknown.
6/25/84	348	M	4	Box Cr.	Green (rototag)	Black	Unknown.
6/28/84	397	M	11	Mettler Coulee	Green (rototag)	Black	Unknown.
6/28/84	330	M	3½*	W. Fk. Sun River	Green (rototag)	Blonde	Recaptured 7/5/84. Hunter-kill July 1985 @ Moose Cr.
7/01/84	400	F	3½*	S. Fk. Sun River	Green (rototag)	Black	Hunter-kill 11/6/85 @ Bighead Cr.
7/03/84	390	M	14	W. Fk. Sun River	Green (rototag)	Brown	Recaptured 6/23/86 & 6/25/86.
8/26/84	376	M	2½*	Simms	Green (rototag)	Black	Relocated to SRGR. Hunter-kill 9/11/84 in Sun River Canyon.
10/07/84	340	M	4	Smith Cr.	Green (rototag)	Cinnamon	Relocated to Beartooth Game Range.
5/14/85	362	F	2½*	Poplar Cr.	Green (rototag)	Brown	Hunter-kill 10/29/85 @ Joslin Basin.
5/19/85	377	M	10	Cuniff Cr.	Green (rototag)	Black	Recaptured 5/16/85 @ Cuniff Cr. and 5/26/85 @ Big Skunk Cr.
5/19/85	337	M	4*	Cuniff Cr.	Green (rototag)	Brown	Hunter-kill 9/28/86.
5/19/85	367	M	4	Cuniff Cr.	Green (rototag)	Brown	Unknown.
5/25/85	370	M	3½*	Cuniff Cr.	Green (rototag)	Black	Hunter-kill 9/6/85 @ Falls Cr.
5/28/85	334	F	14	Cuniff Cr.	Green (rototag)	Brown	Unknown.
5/29/85	351	M	9	Cuniff Cr.	Green (rototag)	Black	Unknown.
6/11/85	304	M	10	Moudess Cr.	Green (rototag)	Brown	Recaptured 6/18/85 @ Moudess Cr.
6/20/85	303	M	9	Dearborn River	Green (rototag)	Brown	Unknown.
6/21/85	309	M	8	Dearborn River	Green (rototag)	Black	Recaptured 5/23/86 @ Smith Cr.
6/23/85	311	M	5	Moudess Cr.	Green (rototag)	Black	Recaptured 5/17/86 @ Smith Cr.
5/15/86	407	M	3½	Smith Cr.	Green (rototag)	Brown	Unknown.
5/16/86	403	M	6½	Willow Cr.	Green (rototag)	Black	Unknown.

* = age at death

Appendix D. Black bears captured on the East Front, 1976-86, (continued).

DATE OF CAPTURE	NO.	SEX	AGE (1986)	LOCATION	EAR TAG (TYPE)	COLOR	FATE
5/16/86	405	F	4½*	Smith Cr.	Green (rototag)	Black	Hunter-kill 5/16/86.
5/18/86	459	M	4½	Badger Cr.	Green (rototag)	Brown	Recaptured 5/23/86, 6/2/86.
5/19/86	406	M	3½	Smith Cr.	Green (rototag)	Brown	Unknown.
5/20/86	408	M	4½	Willow Cr.	Green (rototag)	Brown	Unknown.
5/21/86	404	F	1½	Ford Cr.	Green (rototag)	Blonde	Unknown.
5/21/86	473	M	4½	Badger Cr.	Green (rototag)	Brown	Recaptured 6/1/86.
5/24/86	413	M	2½	Willow Cr.	Green (rototag)	Black	Unknown.
5/24/86	414	M	1½	Willow Cr.	Green (rototag)	Brown	Unknown.
5/25/86	458	M	2½	Badger Cr.	Green (rototag)	Black	Hunter-kill 10/8/86.
5/26/86	415	M	1½	Ford Cr.	Green (rototag)	Brown	Unknown.
5/27/86	416	M	3½	Petty Cr.	Green (rototag)	Brown	Unknown.
5/28/86	457	F	12½	Badger Cr.	Green (rototag)	Black	Unknown.
5/29/86	461	M	6½	Badger Cr.	Green (rototag)	Black	Unknown.
6/12/86	472	M	3½	Badger Cr.	Green (rototag)	Black	Unknown.
6/17/86	468	M	3½	Muskrat Cr.	Green (rototag)	Brown	Unknown.
6/19/86	462	M	Sub-Adult	Badger Cr.	Green (rototag)	Brown	Unknown.
6/23/86	417	F	7½*	Fairview Cr.	Green (rototag)	Black	Hunter-kill 8/2/86.
6/23/86	471	F	9½	Kip Cr.	Green (rototag)	Black	Unknown.
6/28/86	469	M	6½	Kip Cr.	Green (rototag)	Brown	Unknown.
6/28/86	474	M	3½	Muskrat Cr.	Green (rototag)	Brown	Unknown
6/29/86	463	M	9½	Crucifixion Cr.	Green (rototag)	Black	Unknown.
7/10/86	482	F	3½	Badger Cr.	Green (rototag)	Brown	Unknown.
8/30/86	102	M	3½	Teton River	Yellow (rototag)	Brown	Relocated to Whiterock Pass.
8/30/86	103	F	Cub	Teton River	Yellow (rototag)	Cinn.	Relocated to Whiterock Pass.
8/30/86	104	M	Cub	Teton River	Yellow (rototag)	Black	Relocated to Whiterock Pass.

* = age at death

Appendix D. Black bears captured on the East Front, 1976-86, (continued).

DATE OF CAPTURE	NO.	SEX	AGE (1986)	LOCATION	EAR TAG (TYPE)	COLOR	FATE
9/6/86	437	M	10½*	Windfall Cr.	Green (rototag)	Brown	Recaptured 9/9/86 Hunter-kill 9/21/86.
9/7/86	428	F	16½	Lange Cr.	Green (rototag)	Black	Unknown.
9/10/86	427	M	8½	Windfall Cr.	Green (rototag)	Brown	Unknown.
9/11/86	105	F	13½*	Sun River	Yellow (rototag)	Black	Hunter-kill 10/4/86.
9/12/86	434	M	4½	Windfall Cr.	Green (rototag)	Brown	Unknown.

* = age at death

8072/2

Appendix E. Black bears captured, and marked black bears killed by hunters each year for study areas north and south of the Sun River, 1976-1986.

Year	Area	# Bear Captured							# Marked Bears Hunter-Killed						
		Tot.	M	F	AD	SA	YR	C	Tot.	M	F	AD	SA	YR	C
1976	North	5	3	2	4	1	0	0	0	0	0	0	0	0	0
	South	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1977	North	11	9	2	4	7	0	0	0	0	0	0	0	0	0
	South	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1978	North	3	3	0	2	1	0	0	0	0	0	0	0	0	0
	South	2	2	0	2	0	0	0	0	0	0	0	0	0	0
1979	North	4	3	1	3	1	0	0	1	1	0	1	0	0	0
	South	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1980	North	6	5	1	2	4	0	0	3	3	0	3	0	0	0
	South	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1981	North	3	1	2	0	3	0	0	0	0	0	0	0	0	0
	South	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1982	North	7	4	3	2	5	0	0	4	4	0	3	1	0	0
	South	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1983	North	5	4	1	1	4	0	0	3	2	1	2	1	0	0
	South	16	11	5	5	8	3	0	0	0	0	0	0	0	0
1984	North	8	5	3	4	4	0	0	2	2	0	2	0	0	0
	South	26	20	6	9	15	2	0	5	5	0	2	3	0	0
1985	North	-	-	-	-	-	-	-	2	2	-	2	0	0	0
	South	11	9	2	6	5	0	0	7	4	3	2	5	0	0
1986	North	20	13	7	11	7	0	2	3	2	1	2	1	0	0
	South	23	16	7	16	5	2	0	12	8	4	8	4	0	0
Total	North	72	50	22	33	37	0	2	18	16	2	15	3	0	0
	South	78	58	20	38	33	7	0	24	17	7	12	12	0	0
Total		150	108	42	71	70	7	2	42	33	9	26	15	0	0

8072/2

Appendix F. Grizzly bear management guidelines, East Slope, Rocky Mountain Front. (Excerpted from Interagency Rocky Mountain Front Management Guidelines, 1984)

Introduction

The Interagency Rocky Mountain Front Wildlife Monitoring/Evaluation Program was initiated in 1980. A principal goal of this program was to sponsor study efforts; whereby wildlife management guidelines, based on sound scientific findings, could be developed to aid land managers in their planning of human activities along the Rocky Mountain Front.

The original charter for this program specified that management guidelines were to be considered "interim" until five years of study had been incorporated into them. However, the guidelines developed thus far are currently being used as firm guidance by the involved agencies. Further, at the end of this five year period these guidelines should not be locked in concrete by the term "final". It is highly likely that studies will continue and additional findings will dictate new or revised guidelines. Therefore, these two terms will not be used and the management guideline development process and associated document are to be considered part of a dynamic planning process subject to periodic review and modification as additional study findings become available and as long as the need for them is present.

In the event that on-going monitoring results in the need for a new guideline or the modification of an existing guideline, it can be submitted at anytime by the procedures described and on the form given on the last two pages of this document.

The following management guidelines are based on the best information currently available. They are a result of current or recently completed studies on selected wildlife species. Field investigators conducting the studies have completed extensive literature reviews on the various species considered. The guidelines which have been formulated and presented in this document are not only the result of study findings and literature review, but incorporate the professional judgement of the technical personnel involved.

Objective

The need for management guidelines is predicated on management concerns involving the effects of existing and proposed land uses and human activities upon various wildlife species and their habitat. The objective of the development and application of management guidelines is to avoid or minimize the following effects of human related activities which may adversely impact some or all of the selected wildlife species being considered:

A. Physical destruction of important wildlife habitat components.

B. Human disturbance that would displace various wildlife species from important seasonal use areas.

C. Increased direct human caused mortality.

D. Increased stress due to higher human activity levels.

E. Direct mortality or physical impairment resulting from environmental (chemical) contaminates.

F. Increased wildlife/human interaction resulting from habitat intrusion or displacement.

Management Guidelines

Management guidelines provide coordination measures designed to avoid or minimize the potential conflicts previously identified between human related activities and wildlife. Although many of the guidelines are applicable to a variety of human activities, some of them are specific to a single activity. Oil and gas exploration and development has received special emphasis due to the relatively high level of activity in recent years. As a result, some of the guidelines apply specifically to that activity.

Approved management guidelines will be included in permits, contracts or other formal authorizations for human activities as applicable. Omissions or modifications of applicable guidelines in such authorizations will be documented in an EA report or other appropriate document concerning the activity involved.

Monitoring

A majority of the radio tracking and habitat survey data collected to date has been baseline information including the identification of seasonal ranges, reproduction areas, breeding areas and migration corridors. Future studies will place increasing emphasis on the monitoring of effects of increased human activity levels, particularly those associated with oil and gas exploration, on the wildlife species being studied. The management guidelines presented in this document are only partially based on monitoring information collected during the current studies on the Rocky Mountain Front. An important consideration in further monitoring efforts will be to test and validate the guidelines as to their effectiveness and applicability.

PART A. General Management Guidelines

The following general management guidelines are applicable coordination measures that will be considered when evaluating the effects of existing and proposed human activities in identified seasonally important habitats for a variety of wildlife species.

1. Identify and evaluate for each project proposal the cumulative effects of all activities, both existing uses and other planned projects. Potential site specific effects of the project being analyzed are a part of the cumulative effects evaluation which will apply to all lands within a designated biological unit. A biological unit is an area of land which is ecologically similar and includes all of the year long habitat requirements for a sub-population of one or more selected wildlife species.

2. Avoid human activities or combinations of activities on seasonally important wildlife habitats which may adversely impact the species or reduce the habitat effectiveness.

3. Space concurrently active seismographic lines at least nine (9) air miles apart to allow an undisturbed corridor into which wildlife can move when displaced. One line survey crew will be allowed to work between active lines in order to reduce the total time of activity in any one area (Olson, G. 1981).

4. Establish helicopter flight patterns of not more than one-half (½) mile in width along all seismographic lines, between landing zones and the lines, and between landing zones and other operations, unless flying conditions dictate deviations due to safety factors.

5. Because helicopters produce a more pronounced behavioral reaction by big game and raptors than do fixed-wind aircraft, helicopters will maintain a minimum altitude of 600 feet (183 meters) above ground level when flying between landing zones and work areas where landing zones are not located on seismic lines, unless species specific guidelines recommend otherwise (Hinman, H., 1974; McCourt, K.H., et al 1974; Klein, D.R., 1973; Miller, F.L. and A. Guinn, 1979).

6. Designate landing zones for helicopters in areas where helicopter traffic and associated human disturbances will have the minimum impact on wildlife populations. Adequate visual and/or topographic barriers should be located between landing zones and occupied seasonal use areas.

7. The use of helicopters instead of new road construction to accomplish energy exploration and development is encouraged.

8. Base road construction proposals on a completed transportation plan which considers important wildlife habitat components and seasonal use areas in relation to road location, construction period, road standards, seasons of heavy vehicle use, road management requirements, etc.

9. Use minimum road and site construction specifications based on projected transportation needs. Schedule construction times to avoid seasonal use periods for wildlife as designated in the species specific guidelines.

10. Locate roads, drill sites, landing zones, etc. to avoid important wildlife habitat components based on a site specific evaluation.

11. Insert "dog-legs" or visual barriers on pipelines and roads built through dense vegetative cover areas to prevent straight corridors exceeding one-forth (¼) mile where vegetation has been removed (Stubbs, C.W. and B.J. Markham, 1979).

12. Roads which are not compatible with area management objectives and are no longer needed for the purpose for which they were built will be closed and reclaimed. Native plant species will be used whenever possible to provide proper watershed protection on disturbed areas. Wildlife forage and/or cover species will be utilized in rehabilitation projects where deemed appropriate.

13. Keep roads which are in use during oil and gas exploration and development activity closed to unauthorized use. Place locked gates and/or road guards at strategic locations to deter unauthorized use when activities are occurring on key seasonal ranges.

14. Impose seasonal closures and/or vehicle restrictions based on wildlife or other resource needs on roads which remain open.

15. Bus crews to and from drill sites to reduce activity levels on roads. Shift changes should be scheduled to avoid morning and evening wildlife feeding periods.

16. Keep noise levels at a minimum by muffling such things as engines, generators and energy production facilities.

17. Prohibit dogs during work periods.

18. Prohibit firearms during work periods or in vehicles traveling to and from work locations.

19. Seismographic and exploration companies should keep a daily log of activities. Items such as shift changes, shut down/start up times, major changes in noises or activity levels, and the location on the line where seismic crews are working should be recorded.

PART B: Species Specific Management Guidelines

The species specific management guidelines which follow provide coordination measures necessary to protect important habitats or seasonal use areas for several wildlife species which were selected for intensive baseline surveys on the Rocky Mountain Front Study Area. Monitoring of the effects of human activities on these species and their habitats will continue to receive special study emphasis.

Maps which delineate the seasonally important habitats for which timing restrictions are specified have not been included in the management guideline document and are not available for general distribution. Copies of these maps are available for inspection at the offices of the four Agencies involved in the Rocky Mountain Front Wildlife Monitoring Program.

These guidelines together with the "general management guidelines" will minimize, but not eliminate, the impacts of disturbances caused by human activities on these species. Species specific guidelines are currently available for grizzly bear, mountain goat, bighorn sheep, elk, mule deer and raptors.

Grizzly Bear

The Interagency Grizzly Bear Committee approved the application of guidelines on National Forest System, Bureau of Land Management (BLM) and National Park System lands throughout grizzly bear ecosystems in the States of Idaho, Montana, Washington, and Wyoming. (November 26, 1986 Federal Register, Vol. 51, No. 228). These guidelines are known as the Interagency Grizzly Bear Guidelines (IGBG). The IGBG provide definition and management direction for grizzly bear Management Situations I, II, III, IV and V and further provide generalized guidelines on "how to coordinate various activities with the bear in the various management situations. Further, the IGBG were more specifically developed for the Yellowstone Ecosystem.

The Rocky Mountain Front Guidelines (RMFG) found in this document do not identify management situations or provide definitions or management directions of the stratification. The Management Situations designated on the Front pursuant to the IGBG identify where the emphasis on grizzly bear needs to be placed, and if there is a conflict, where the conflict should be resolved in favor of the bear; but the RMFG are the best management practices for coordinating multiple use activities with the grizzly bear on the Front. The RMFG are detailed coordination measures for specific activities that will assist land managers in meeting the management direction provided in the IGBG.

Study results documented to date along the east Rocky Mountain Front are the basis for the development of management guidelines for grizzly bear and their habitat. During the period from 1977-1979, research was carried out by the Border Grizzly Project under a contract with the BLM. Since 1980 the Montana Department of Fish, Wildlife and Parks has assumed the intensive grizzly bear monitoring work with funding continuing from the Interagency Rocky Mountain Front Task Force private industry (American Petrofina, Williams Exploration, Sun Exploration) and the Nature Conservancy. In addition, a BLM funded livestock/grizzly bear interaction study was conducted by a graduate student from Montana State University during the field seasons of 1985 and 1986.

These guidelines were developed as a direct result of grizzly bear monitoring conducted on the East Front. They represent guidelines that, when followed, will mitigate but not eliminate influences of human activities on grizzly bears and grizzly bear habitat. Human activities within grizzly bear range will have effects, however subtle, on grizzly bears.

All previously mentioned "general management guidelines" are applicable coordination measures that should be considered when evaluating human activities in grizzly bear habitat. The following are additional species specific guidelines.

1. Avoid human activities in identified grizzly bear habitat constituent elements or portions of constituent elements containing specific habitat values during the following seasonal use periods (see data summarization):

   A. Spring habitat (concentrated use areas)----April 1 - June 30
   B. Alpine feeding sites----------July 1 - September 15
   C. Subalpine fir/whitebark pine habitat types--August 1 - November 30
   D. Denning habitat----------October 15 - April 15.

2. Avoid human activities in grizzly bear habitat components which provide important food sources during spring and early summer, April 1 - July 15. These habitat components include riparian shrub types, Populus stands, wet meadows, sidehill parks, and avalanche chutes. Maintain an undisturbed zone of at least ½ mile between activities and the edge of these habitat components where many important bear foods occur.

3. Establish flight patterns in advance when activities require the use of helicopters. Flight patterns should be located to avoid seasonally important grizzly bear habitat constituent elements and habitat components during the designated seasonal use periods.

4. No seismic or exploratory drilling activities should be conducted within a minimum of one mile of den sites during the October 15 - April 15 period (Reynolds, P.E., et al, 1983).

5. Seismic permits should include a clause providing for cancellation or temporary cessation of activities, if necessary, to prevent grizzly/human conflicts.

6. Scheduling of well drilling on adjacent sites, within important grizzly bear use areas, should be staggered to provide a disturbance free area for displaced bears.

7. Pipeline construction required for the development of a gas or oil field should be condensed into the shortest time frame possible and subject to seasonal restrictions when conducted in important grizzly bear habitat.

8. Field operation associated with seismic or oil/gas exploration activities should be placed carefully to avoid seasonally important habitat components or constituent elements. Such placement of sites is necessary in order to avoid direct or potential conflicts between man and grizzly bear.

9. Retain frequent dense cover areas adjacent to roads for travel corridors and security cover necessary to protect important habitat components. Three sight distances are desirable to provide visual security for grizzlies. A sight distance is the average distance at which a grizzly or other large animal is essentially hidden from the view of an observer by vegetation cover. The same security cover guidelines also applies to timber harvest units.

10. No off-duty work camps will be allowed within occupied seasonally important constituent elements.

11. Incinerate garbage daily or store in bear proof containers and remove to local landfill dumps daily.

12. Commercial activities permitted on public land should be planned and coordinated to avoid conflicts with grizzly bear trapping operations being conducted under the monitoring program. General public use of areas where trapping operations are active will be controlled through appropriate administrative actions by the agencies involved.

The following are grizzly bear management guidelines specifically oriented toward livestock grazing:

1. Livestock grazing on important spring habitat for grizzly bears should be deferred until after July 1.

2. In pastures grazed after July 1, cattle should be removed before the amount of the riparian forage base is reduced by 50 percent by either grazing or structural damage.

3. Exceptions to the July 1 entry date can be made when a pasture is part of a grazing system (for example, rest rotation or deferred rest rotation) that does not cause a decrease in the condition or size of the riparian plant communities.

4. In riparian habitats that receive high amounts of bear use, fencing to exclude livestock grazing and trampling may be necessary.

5. Boneyards and livestock dumps are prevalent along the East Front and are frequented by grizzly bears. Ranchers and landowners should be encouraged to place carcasses of dead livestock and garbage on remote areas of their land. Dead cows and calves should be hauled a considerable distance from calving grounds to discourage bears from feeding on carion and newborn calves.

6. Options given in the IGBG for sheep allotments where grizzly - livestock depredation has been authenticated will be followed and include:

   (a) change the season of use, bedding practices, or grazing area to avoid known problem areas or other habitat important to grizzlies in time and space;

   (b) change the class of livestock from sheep to cattle if the range is suitable for cattle; or

   (c) remove all livestock and close the allotment. Vacant sheep allotments will not be restocked with sheep.

In addition to the guidelines listed above for livestock grazing practices, the following research/management recommendations are presented:

1. The condition and trend of all riparian plant communities and their production of Angelica arguta, Heracleum lanatum, and Osmorhiza occidentalis need to be determined on all East Front public lands grazed by livestock.

2. For pastures where the condition of riparian plant communities needs improving, the construction of special use pastures is recommended. A special use pasture should be constructed where large areas of riparian vegetation are enclosed so an adequate forage base will be available to allow for stocking rates compatible with livestock operations. (Exclosures should be considered if riparian areas are too small.) These pastures should only be grazed after July 1, and the livestock should be removed before the special use pastures should be incorporated into a deferred rest rotation grazing system similar to that described by Marlow (1985). Some other methods which may be used to reduce impacts to riparian include; development of alternate water sources, placement of salt away from riparian, and improved herding practices.

3. For riparian areas where the abundance of important plant species used by grizzlies for cover (Populus tremuloides, Populus tricocarpa, Salix spp., or Betula spp.,) or food (Angelica arguta, Heracleum lanatum, or Osmorhiza occidentalis) has been reduced, reestablishment should be attempted.

Marlow, C.B. 1985. Controlling riparian zone damage with little forage loss. Montana Agricultural Experiment Station. Montana State University. Montana AgResearch 2(3): 1-7.

8072/2